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AN EVIDENCE-BASED APPROACH TO EMERGENCY MEDICINE

Fever In The Elderly: How To Surmount The Unique Diagnostic And Therapeutic Challenges

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CME Objectives

Upon completing this article, you should be able to:
1. describe the significance of fever in the elderly;
2. identify the common etiologies of fever in this population;
3. identify the key points of the history and physical of the febrile elderly patient; and
4. describe the appropriate empiric antibiotic treatment for the febrile elderly patient in the ED.

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JUST as "children are not little adults," the elderly cannot be considered superannuated specimens. Physiologic and behavioral differences demand that emergency physicians manage illness in the elderly differently than we do in younger adults. In fact, two central medical principles used for children can be applied to the elderly: Patients are more vulnerable, and symptoms are much less specific.

This issue of *Emergency Medicine Practice* will address the unique issues involved in assessment and treatment of the febrile senior. Special attention is given to differences in presentation between the infected elderly and younger adults. We also emphasize changes in management due to comorbid disease. The specific recommendations for disposition and antibiotic therapy are tailored to the ED setting.

Epidemiology, Etiology, And Pathophysiology

The definition of "elderly" varies. While the authors consider the definition of elderly to be 20 years older than we are, this shifting interpretation has limited utility. Most medical researchers consider "elderly" to be older than 64. The percentage of elders continues to grow in our population. In 1980, 11.3% of the U.S. population was elderly. It is estimated that this portion will increase to 13% by 2000 and to almost 25% in 2020.[1,2] There has also been a steady increase in ED utilization by the aged over the past 10 years.[1] The elderly also make up a disproportionate percentage of hospital admissions, up to 40% in some studies, as well as a disproportionate number of EMS runs.[1] These numbers reflect the current and future challenges to emergency medicine, especially considering that the diagnostic evaluation of the elderly is significantly more complex than in their younger counterparts.[3]

Fever in the elderly is a common complaint. Approximately 10% of elderly patients will have a fever when presenting to the ED.[4] Of these, 70-90% will be admitted, and 7-10% will die within one month, as compared to

less than 1% of inpatients 17-59 years old.[4,5] Infectious disease is the most common cause of fever in the elderly patient presenting to the ED and is the most common reason for admission to the hospital in this population.[4,6]

Fever in the elderly should be regarded with concern. Its presence usually presages serious disease. Most fevers in the aged are caused by infections, and even in chronic fevers (fevers of unknown origin), more than one-third are due to microbes. Unlike fever in younger patients who often harbor a benign viral syndrome, fever in the elderly is typically associated with bacterial disease.[7,8] (See **Table 1**.)

Appreciating the geriatric physiology helps explain the diminished fever response noted in this population. Fever occurs when the hypothalamic set point is fixed to a higher temperature. This is a response to cytokines, such as IL-1, IL-6, and TNF, which are released by leukocytes in the presence of infection, neoplasm, toxins, drugs, or immune complexes.[9,10] The hypothalamus releases prostaglandin E in response to these cytokines. The cascade affects vasomotor centers, sympathetic nerves, and vasculature to decrease heat dissipation and to increase body temperature.[11]

Many of these pathways, illustrated in **Figure 1**, are blunted in the elderly.[7,12] Aging and vascular changes may also affect the hypothalamic circulation and interleukin response, resulting in a diminished fever.[7] In addition, altered mental status and malnutrition, both common in elderly patients, are associated with a decreased fever response.[13,14] Hippocrates wrote in Aphorism, "The fevers of old men are less acute than others, for the body is cold."[15] In fact, elderly people often have a lower baseline temperature.[16,17] This, in addition to the blunted fever response, makes an elderly patient less likely to reach a temperature traditionally considered a fever.

Though less likely to have a fever, older patients are more likely to develop an infection than younger adults. The explanation for this increased susceptibility is multifactorial. First, elderly patients have decreased natural barriers to infections. Fragile skin with decreased vasculature and less subcutaneous tissue contributes to slower wound healing and increased risk for skin infections.[18] A less vigorous cough and decreased mucociliary clearance may predispose to pneumonia, particularly in patients with COPD.[19] Comorbid illnesses also contribute to increased susceptibility. Diabetes mellitus and various malignancies can diminish the immune response. Impairments in cell-mediated immunity also contribute to increased infection rates in this population.

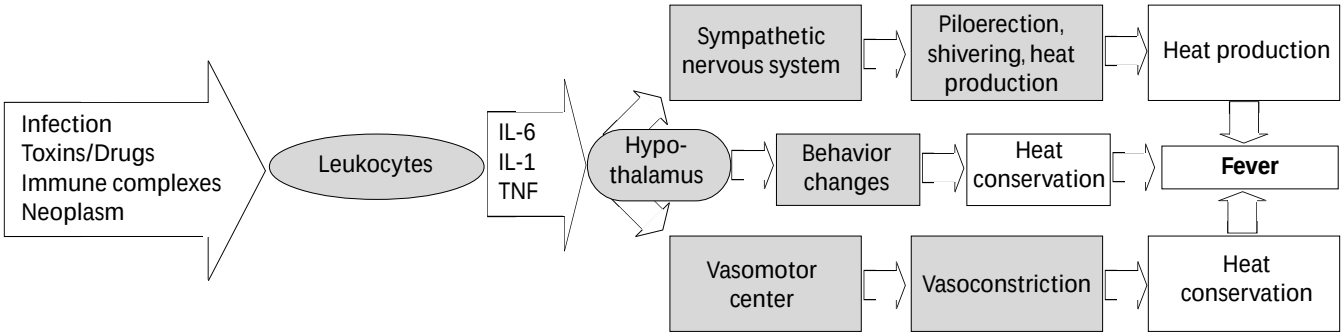
The elderly are also at increased risk for hyperthermia, defined as a temperature greater than 41°C. This is frequently due to high ambient temperatures, complicated by behavior deficits, medicines, and malnutrition.[20] The impoverished or isolated elderly may be unable to escape the heat.[21] Peripheral mechanisms of vasodilatation and sweating become insufficient or are overwhelmed by excess external or internal heat.[22] Furthermore, many medications commonly prescribed for the elderly impair their ability to dissipate heat. These medicines include thyroid hormone, anticholinergics,

Table 1. Final Diagnoses Of Febrile Elderly Presenting To An Emergency Department.[5]

Final Diagnoses	Among Febrile Elderly Presenting To ED (470 patients total)
Infectious	**89.4%***
Respiratory tract infections	31.5%
• Pneumonia	24.9%
• Bronchitis	6.0%
• Pharyngitis/Sinusitis	1.3%
Urinary tract infection	21.7%
Skin/Soft tissue infection	5.3%
Bacteremia/Sepsis	17.7%
Cholecystitis/Biliary tract	3.0%
Diverticulitis/Abscess	2.3%
Colitis/Enteritis	2.3%
Meningitis/Encephalitis	1.1%
Osteomyelitis	1.1%
Appendicitis	0.6%
Epididymitis/Prostatitis	0.6%
Viral syndrome	2.6%
Noninfectious	**10.4%***
Diagnosis U nknown	**5.7%***

* These categories do not total 100% because each patient may have had more than one diagnosis.

Figure 1. Pathophysiology Of The Development Of Fever.*



*Shaded boxes indicate possible impairment due to pharmacologic, physiologic, or psychologic aspects of aging.

phenothiazines, tricyclic antidepressants (TCAs), lithium, MAO inhibitors, and diuretics.[6]

Differential Diagnosis

The elderly can suffer significant morbidity or mortality if an infectious diagnosis is missed. The infectious syndromes listed in **Table 2** are associated with significantly higher mortality in the older adult. Overall, infections account for up to 40% of all mortality in those 65 or older.[23] For these reasons, the emergency physician must consider infection, regardless of a fever, in the differential diagnosis of any senior presenting to the ED.

Although the potential etiologies of fever in the elderly are legion (see **Table 3**), numerous studies have identified respiratory, urinary tract, and soft-tissue infections as the predominant causes of fever in elderly who present to EDs.[5,24-28] These three types of infections account for 80% of secondary bacteremia in nursing home facilities.[29] The emergency physician can use the acronym PUS (**P**neumonia, **U**TI, **S**oft Tissue) to remember these diagnoses when evaluating the febrile elderly patient.[24] Other diagnoses should be pursued when suggested by the history and physical exam or when an investigation of the "PUS" triad is negative.

Infectious syndromes are over-represented in the geriatric population. Forty percent of all cases of bacteremia and sepsis occur in the elderly, and are responsible for an estimated 60% of deaths. Gangrene of the appendix and gallbladder are more common in the elderly, while diverticulitis is found almost exclusively in the older patient. Sixty percent of tetanus and the majority of shingles occur in the elderly. Tuberculosis is also disproportionate, especially in nursing homes.[30]

In formulating the differential diagnosis, it is important to consider the patient's functional status and living situation. Nursing home residents are more likely to develop nosocomial pneumonia, complicated urinary tract infection, or infected pressure ulcers than the independent elderly. For the recently hospitalized, consider a surgical wound infection or septic thrombophlebitis.[30]

Table 2. Relative Mortality Rates Of Common Infectious Diseases In The Elderly.

Infection	Relative Mortality When Compared With Young Adults
Endocarditis	2-3x
Pneumonia	3x
Bacterial meningitis	3x
Sepsis	3x
Cholecystitis	2-8x
Urinary tract infection	5-10x
Tuberculosis	10x
Appendicitis	15-20x

Adapted from: Yoshikawa TT. Perspective: Aging and Infectious Diseases. *J Infect Dis* 1997;176:1053.

ED Evaluation

Sir William Osler said: "In the old and debilitated, a knowledge that the onset of pneumonia is insidious and that the symptoms are ill-defined and latent should place the practitioner on his guard and make him very careful."[31] Osler's statement holds true for not only pneumonia but nearly all diseases in the elderly.

"Textbook" symptoms are the exception rather than the rule in the febrile elderly patient. A behavioral change may be the only hint of an underlying infection. At least 75% of all episodes of functional decline in nursing home patients are due to infection.[32] It is a common mistake to assume that the confused 80-year-old is "just demented," when in fact he or she may be a normally intact and independent person with acute delirium secondary to a UTI.[18] Ask family members or caretakers about recent falls, anorexia, decreased activity, new incontinence, or confusion. (See **Table 4** on page 4.) These may be the only clues to a serious illness. Make an effort to define the patient's baseline functional and mental status. Five minutes on the telephone with the primary care provider or the patient's daughter may prompt life-saving antibiotics instead of an inappropriate prescription for Haldol.

Table 3. Differential Diagnosis Of Fever In The Elderly Patient.[5,7,25,27,28,30]

Infectious

- Respiratory:
  - Bacterial pneumonia
  - Influenza
  - Tuberculosis
  - Bronchitis
  - Sinusitis
  - Pharyngitis
  - Otitis media
- Genitourinary:
  - Urinary tract infection
  - Epididymitis
  - Prostatitis
- Skin/Soft tissue:
  - Cellulitis
  - Infected pressure ulcer
  - Conjunctivitis
- Musculoskeletal:
  - Osteomyelitis
  - Septic arthritis
- Neurological:
  - Meningitis
  - Encephalitis
  - Abscess
- Gastrointestinal:
  - Appendicitis
  - Cholecystitis
  - Diverticulitis
  - Colitis/Enteritis
  - Abscess
  - Peritonitis
- Cardiovascular:
  - Endocarditis
  - Vascular infection
- Systemic:
  - Bacteremia
  - Sepsis

Noninfectious

- CVA
- Deep venous thrombosis
- Intracranial hemorrhage
- Myocardial infarction
- Pulmonary embolism/ Thrombosis
- Pulmonary edema/ CHF
- Malignancy
- Collagen vascular disease
- Severe dehydration
- Drug-related:
  - Aspirin
  - Neuroleptic malignant syndrome
  - Serotonin syndrome
  - Sympathomimetics
  - Anticholinergics
- Large hematoma
- Environmental hyperthermia
- Recent seizure
- Thyroid storm
- Gout

History Of Present Illness

Emergency physicians often hear the familial lament, "Grandpa just hasn't been acting right." This imprecise account can be an important clue to a life-threatening infection. Nearly one-fifth of geriatric patients with a serious infection will present with a vague history and diffuse complaints.[4]

Sepsis

Emergency physicians correctly predict bacteremia in less than two-thirds of elderly patients.[33] This is often because the associated symptoms in the elderly are so nonspecific. When compared with a younger population, older patients with bacteremia more often present with recurrent falls, malaise, or change in functional or mental status.[34] In one ED study, only a change in mental status and vomiting independently predicted bacteremia in the elderly.[33] These nonspecific symptoms make identifying an infectious source extremely difficult. For example, anorexia, malaise, and nausea are far more common than dysuria or urgency in elderly with urosepsis.[35]

Pneumonia

Symptoms of pneumonia can also be atypical in the elderly. (See **Table 5**; also, see the September 1999 issue of *Emergency Medicine Practice*, "Community-Acquired Pneumonia: Deciding Whom To Admit And Which Antibiotics To Use.") Again, Osler wrote, "In senile pneumonia, the temperature may be low and yet brain symptoms are very pronounced."[36] Perhaps the most common symptom of pneumonia in the elderly is a change in mental status, which is seen in up to 65% of cases.[37,38] Ten percent will present with a history of recent falls.[39] To further complicate matters, more than half of elderly patients with pneumonia may lack cough or sputum production; fever is absent in up to 65%.[37,40]

Table 4. Historical Clues To Infections In The Elderly.

Acute confusion or delirium
Change in functional status
Change in behavior pattern
Anorexia
Weight loss
Weakness
Lethargy
Recurrent falls
New urinary incontinence

Adapted from: Yoshikawa TT, Norman DC. Approach to fever and Infection in the nursing home. *J Am Geriatr Soc* 1996;44:74-82.

Table 5. Signs And Symptoms Of Pneumonia In Elderly Patients.

Sign/Symptom	Frequency
Recent falls[37,39]	10%
Tachycardia[39,57]	10-15%
Tachypnea (RR>30)[39,55]	26-75%
Change in mental status/confusion[37,40,57]	33-60%
History of cough, fever, or dyspnea[57]	44%

Likewise, elderly patients with tuberculosis are less likely to have the classical symptoms of weight loss, night sweats, and hemoptysis.[41]

Urinary Tract Infection

Lower urinary tract symptoms—dysuria, urgency, and frequency—may also be absent in the elderly, particularly in those with indwelling urinary catheters. (See **Table 6**.) Symptoms of fever, chills, nausea, and flank and costovertebral pain can be attenuated or even absent.[42] Instead, altered mental status, vomiting, abdominal tenderness, respiratory distress, and rales may dominate the clinical picture.[43] Lack of fever, and even hypothermia, further muddy the diagnostic waters. This atypical presentation may perplex the most astute clinician—in one study of elderly uncatheterized patients with pyelonephritis, the initial diagnosis was incorrect in 21% of cases.[31]

Intra-abdominal Infection

While any type of intra-abdominal infection may occur in the elderly, by far the most common and problematic are appendicitis, cholecystitis, and diverticulitis. The elderly frequently lack the characteristic focal abdominal tenderness, which usually distinguishes these pathologies. (See **Table 7**.) Perforation of a viscus and subsequent peritonitis can occur without pain or fever.[44] In fact, confusion and hypotension may be the only symptoms of gastrointestinal infection.[45] This high rate of atypical presentation, and the tendency of the elderly patient to delay presentation, can lead to poor outcome.[46] Although the elderly account for only 5-10% of cases of appendicitis, they account for 60% of the deaths from this disease. Complications such as gangrene, perforation, abscesses, and peritonitis occur in 35-65% of cases, far more often than in younger counterparts.[46] Cholecystitis is the most common cause for surgery in the elderly. In this age group, it is much more likely to progress to gangrene, perforation, suppurative cholangitis, and emphysematous cholecystitis.

Past Medical History

Some atypical presentations of disease in the elderly are due to underlying illnesses; more than 85% of geriatric patients have one or more chronic diseases.[19] Classical symptoms may be obscured by an exacerbation of these chronic conditions. Pulmonary edema may mask pneumonia, while pre-existing dementia may conceal meningitis. In addition, chronic diseases predispose to specific acute illnesses. (See **Table 8**.) For this reason, obtaining a thorough past medical history can be important in the

Table 6. Signs And Symptoms Of Pyelonephritis In Elderly Patients.[42]

Sign/Symptom	Frequency
Gastrointestinal symptoms	11%
Pulmonary symptoms	14%
Constitutional symptoms	20%
Costovertebral angle tenderness	50%
Irritative voiding symptoms	54%

emergency evaluation of the elderly patient. Calls to the medical records department and the primary care provider may be invaluable.

Past medical history can provide important clues to current fever. A history of rheumatic heart disease or a pacemaker places the patient at increased risk for endocarditis.[48-50] Elderly with incontinence are more likely to have infected pressure ulcers or UTIs,[51] while peripheral vascular disease and chronic venous stasis are risk factors for cellulitis.[52] Many elderly are further immunocompromised by diabetes, corticosteroids, malignancy, ESRD, or HIV. Knowledge of these conditions should increase suspicion for a serious infection.

Determine the presence of "hardware" in the elderly patient with fever. An artificial joint, pacemaker, ventriculo-peritoneal shunt, or prosthetic valve may represent a nidus for infection. Dialysis patients are at special risk for infected central lines and shunts.

A thorough medication history is also essential. New medications may cause a "drug fever." More importantly, recent antibiotics may contribute to a partially treated infection or signify a resistant organism. Question the patient or caretaker regarding antipyretic use, which may mask a fever. The elderly are also at risk for chronic salicylate poisoning, which is an occasional cause of hyperpyrexia. Steroids are a red flag. Geriatric patients on steroids may have few or no stigmata of infection. Recent chemotherapy must prompt a CBC to evaluate for neutropenia. Finally, obtain an immunization history, especially for pneumococcal, influenza, and tetanus vaccines.

Table 7. Signs And Symptoms Of Abdominal Infections In Elderly Patients.

	Sign/Symptom	Frequency
Appendicitis	Rectal pain[60,61]	3-45%
	Palpable mass[61,132,134]	7-22%
	Nausea/Vomiting[135]	30%
	Anorexia[135]	34%
	Rebound[60,61,132-134]	38-81%
	Guarding[61,133,134]	39-51%
	Right lower quadrant tenderness[60,61,132-134]	77-99%
Cholecystitis	Jaundice[58,136]	8-28%
	Change in mental status/confusion[136]	13%
	Palpable mass[58,135]	18-20%
	Peritoneal signs[64]	41%
	Abdominal pain[58,135,136]	74-84%
Diverticulitis	Diarrhea/Constipation[136]	19-40%
	Palpable mass[135,136]	20%
	Nausea/Vomiting[136]	30-41%
	Left lower quadrant pain[135,136]	67-87%

Table 8. Factors Predisposing To Acute Infection In The Elderly.

Chronic Condition	Acute Infection
COPD	Pneumonia, influenza, aspiration[137]
Indwelling urinary catheter	UTI[81]
Prostatic hypertrophy	UTI[77]
Incontinence	Infected pressure ulcers[50]
Peripheral vascular disease	Cellulitis[51]
Stroke	Aspiration pneumonia
Dementia	Aspiration pneumonia[138]
Rheumatoid arthritis	Septic arthritis[139,140]
Osteoarthritis	Septic arthritis[139,140]
Joint prosthesis	Septic arthritis[139,140]
Rheumatic heart disease	Endocarditis[47-49]
Valvular prosthesis	Endocarditis[47-49]
Pacemaker/Defibrillator	Endocarditis[47-49]
Steroid therapy	Increased risk for all infections
Malignancy	Increased risk for all infections
ESRD	Increased risk for all infections
Diabetes	Increased risk for all infections
Cirrhosis	Increased risk for all infections

Physical Exam

"In diagnosing infections in the elderly, physicians must learn to expect the unexpected."[19] As emergency physicians, we reflexively associate infection with fever. In the elderly, however, fever is often absent despite serious infection. Thirteen to forty-seven percent of geriatric patients will be afebrile in the presence of a documented infection.[36,39,48,49,52] (See **Table 9**.)

Fever is not alone in its diminished association with bacterial pathology. All of the usual suspects—tachycardia, characteristic abdominal pain, and peritoneal signs—are seen less frequently despite serious and often life-threatening disease. However, what these signs lack in frequency, they gain in significance.

Temperature

In some cases, fever in the older patient may go unrecognized. A prospective study by Castle et al monitored temperature responses to documented infections in nursing home residents.[54] The standard definition of fever, temperature greater than 101˚F, offered only a sensitivity of 40% and a specificity of 99.7% in this population. They demonstrated that lowering the fever criteria to 99˚F better predicts infections in the elderly, with a sensitivity of 83% and specificity of 89%.

A significant number of elderly have no fever (defined as 101˚F) with documented infection, but they

Table 9. Elderly Without A Fever In The Presence Of A Documented Infection.*

Infection	Percent Afebrile On Presentation
Meningitis	0-41%[141]
Bacteremia	13-24%[33,69]
Appendicitis	26%[61]
Bacterial endocarditis	27-45%[47,48]
Cholecystitis	38-71%[58,64,142]
Pneumonia	40-67%[37,40]

*Age ranges and definitions of fever differ slightly between studies.

do have a rise of 2.4˚F or more from their baseline temperature.[55] These studies suggest that a temperature of 99˚F or a change in temperature of at least 2˚F from baseline in an elderly individual should make the EP suspect a serious underlying infection.[7] The presence of hypothermia not only suggests infection, but predicts a poor outcome in the geriatric population.

Pulmonary

The respiratory rate is one of the most valuable aspects of the respiratory exam. Tachypnea (RR > 30 breaths / min) occurs in 26-75% of elderly patients with pneumonia.[39,55] In some cases, a fast respiratory rate may precede other clinical findings of pneumonia by as much as 3-4 days.[56] The fifth vital sign, pulse oximetry, is easily obtained and may illuminate otherwise subtle respiratory compromise. While the presence of crackles on lung auscultation should alert the emergency physician to the possibility of pneumonia, the exam may be misleading due to chronic lung disease or atelectasis.

Cardiovascular

Like fever, tachycardia can augur serious illness in the elderly. In a cohort of 470 febrile elderly patients presenting to the ED, a heart rate of 120 bpm or greater independently predicted serious illness.[5] In another study, tachycardia was the presenting sign in 15% of elderly patients with pneumonia.[58] However, the absence of tachycardia cannot reassure the emergency physician. Up to 70% of geriatrics with proven bacteremia may lack tachycardia.[34]

Seventy-five percent of elderly patients who develop endocarditis have a predisposing valvular or cardiac lesion, and nearly one-third have a prosthetic valve.[47] Although challenging in a noisy ED, the emergency physician should listen carefully for a heart murmur.

Abdominal

If present, abdominal tenderness is an important finding in this population. Right upper-quadrant or epigastric pain is elicited in 74-84% of elderly patients with cholecystitis.[58] Right lower-quadrant pain or tenderness occurs with most cases of appendicitis,[69-72] while left lower-quadrant pain is found in two-thirds of elderly patients with diverticulitis.[63] However, the disturbing corollary is that a significant number of elderly patients who present with a surgical emergency *have no significant abdominal tenderness*—estimated at up to 25% in cholecystitis, 34% in appendicitis, and 13-30% in diverticulitis.[46,63,64]

Neurological

Establishing orientation and general mental function in the elderly is essential. As mentioned before, a new decline in mental status may be the only objective sign of a life-threatening illness. The emergency physician should search for focal neurological findings. A surprising 40% of elderly with bacterial meningitis have a focal neurological deficit, while nearly half lack meningismus on presentation.[65-68] (See **Table 10**.) The finding of a "stiff neck" may be misleading, as the nuchal rigidity associated with meningitis can be difficult to distinguish from chronic cervical arthritis or chronic neurologic disease such as Parkinsonism.

Genitourinary

Costovertebral angle tenderness may represent an upper urinary tract infection, though some studies suggest that this finding occurs in less than half of the elderly with pyelonephritis.[69] Suprapubic tenderness may indicate cystitis. A rectal examination is necessary to detect prostatitis in the elderly male. However, prostatic massage is not indicated to obtain cultures, as this practice induces bacteremia. On occasion, an examination of the external genitalia may reveal redness, tenderness, or discharge. Any vaginal or penile discharge should be cultured—remember that even octogenarians contract sexually transmitted diseases.

Skin/Soft Tissue

Begin the skin examination by completely undressing the geriatric patient. Cellulitis can be easily overlooked if the lighting is poor or the patient is only partially disrobed. Look for surgical scars, which may reveal a wound infection or clues to the patient's medical history, such as prior splenectomy, pacemaker insertion, or artificial joint. While the patient may demonstrate peripheral evidence of endocarditis, petechiae, Osler nodes, and Janeway lesions are all less common in the elderly.[49]

Make a special effort to find pressure ulcers in the immobile, incontinent, or nursing home patient. Twenty to twenty-five percent of nursing home inhabitants have skin ulcers, and 10-65% of these will be infected.[70,71] The most common locations include the heels, the sacrum, ischial tuberosities, and the buttocks—all areas that can easily be overlooked on a superficial exam of a supine patient.[71] Infected ulcers are suggested by expanding erythema, purulent drainage, foul odor, or necrotic tissue.[50] Chronic non-healing ulcers may indicate an underlying osteomyelitis, especially when bone is exposed.

Finally, inspect the joints in geriatric patients, especially those with prosthesis. Joints with erythema, warmth, or effusion may be infected and should be aspirated for synovial fluid analysis. Pain on range of motion is the most reliable sign of a septic joint.

Diagnostic Studies

Some argue that the workup of fever at the extremes of age is simple—just do everything. While this hyperbole represents an oversimplification, it holds a kernel of truth.

Table 10. Signs And Symptoms Of Meningitis In Elderly Patients.

Sign/Symptom	Frequency
Headache[66-68]	21-81%
Focal neurological signs[65]	40%
Meningismus[66-68]	57-92%
Confusion[66-68]	57-96%

Although the history and physical examination should guide test selection, the emergency physician should use laboratory and imaging studies liberally in the febrile senior, despite the current climate of cost-reduction.

If an infectious cause for fever is suspected, helpful tests may include a complete blood count and differential, at least two sets of blood cultures, urinalysis with culture, chest x-ray, and a creatinine level. The Clinical Pathway "Treatment Of The Elderly Patient With Pneumonia" on page 13 outlines a general approach to the diagnostic and initial management dilemmas in the febrile elderly. **Table 11** lists the pros and cons of specific laboratory and imaging tests for the most common infections in this population.

Table 11. Diagnostic Tests For Causes Of Fever In The Elderly Population.

Pneumonia/Tuberculosis

Test	Pros	Cons
Chest x-ray	"Gold standard," cheap, should be obtained.	May be normal in dehydrated patients or difficult to interpret in chronic lung disease.
WBC	If elevated may indicate infection; low WBC is associated with worse prognosis.[37]	Often not elevated (only 66% >10,000),[143] and elevation is nonspecific.
Sputum culture	If immediate, Gram's stain may help in diagnosis.	Not recommended unless TB or fungus suspected;[55] also, does not assist EP in making diagnosis.
Blood cultures	Will be positive in 28% of pneumonia cases.[41] When done, associated with better morbidity and mortality.[39]	Does not assist EP in making diagnosis.
PPD	Diagnostic for TB exposure.	Must have follow-up in 48-72 hours. No immediate diagnosis is possible. Positive PPD may represent old infection.

Influenza

Test	Pros	Cons
Nasal cultures	May assist health officials and chronic care facilities in tracking outbreak.	Does not assist EP in confirming clinical diagnosis.

Urinary tract infection

Test	Pros	Cons
Pyuria (>10 WBC/HPF)	Inexpensive and rapid.	Presence does not correlate well with bacteriuria and thus UTI in the elderly.[144] Present in 90% of asymptomatic bacteriuria.
Leukocyte esterase	Cheap and is a dipstick marker of pyuria.	See above.
Bacteriuria	Easy, cheap.	A febrile patient may have asymptomatic bacteriuria and an infection falsely ascribed to the urinary tract.
Nitrite	More specific, but less sensitive than LE. Very sensitive for gram-negative organisms. Cheap.	Sensitivity is 35-85%.[145] Negative if bacteria doesn't reduce nitrate (*Pseudomonas* sp. and *Enterococcus*).
Hematuria	May indicate obstructive pyelonephritis. Cheap.	Limited diagnostic use.
Urine culture	Vital to direct therapy. Elderly patients are more prone to polymicrobial and atypical pathogens.	Does not assist EP in making diagnosis.
WBC with differential	Neutropenia may indicate severe disease.	Generally has little bearing on either diagnosis or treatment.
Blood cultures	May reveal unknown systemic infection and affect inpatient treatment.	Has no bearing on ED treatment or diagnosis. High false-positive rate.[146] Urine cultures more appropriate.

Decubitus ulcers

Test	Pros	Cons
Swab culture	Easy and cheap.	Usually grows normal skin flora and is no longer recommended.
Tissue culture	Accurate. Useful if atypical/gram-negative flora suspected.	Invasive. Unnecessary if normal skin flora suspected.
Blood cultures	If positive, will change inpatient therapy. (Decubiti are the third most common source of bacteremia.)	If negative, not helpful.
X-ray	May show underlying osteomyelitis. (Osteo present in up to 26% of nonhealing decubs.[50])	If negative, not helpful.

(Continued on page 8)

Pulmonary Infections

Few diagnostic tests can challenge the chest x-ray in terms of "bang for the buck"—it is money well spent in the evaluation of the febrile older adult. One large prospective study of patients older than 75 with chest complaints or fever demonstrated a greater than 80% incidence of acute findings on chest X-ray.[72] Other studies demonstrate that almost one-quarter of elderly patients presenting with acute confusion and a benign physical exam will have pneumonia by x-ray.[38] When possible, always obtain PA and lateral chest views. Decubitus views of the chest may be indicated if an effusion is noted or suspected.

In some patients, however, the chest film may be misleading. The acutely ill and dehydrated patient may lack a characteristic infiltrate despite pneumonia. In case of strong suspicion, a repeat x-ray after adequate rehydration may demonstrate an infiltrate. On the other hand, many chronic diseases that predispose to bacterial pneumonia, such as COPD and CHF, may obscure radiographic findings.

Once the chest radiograph demonstrates pneumonia, additional tests may be helpful. Pleural fluid in the

Table 11. Diagnostic Tests For Causes Of Fever In The Elderly Population. (continued)

Septic arthritis[147]

Test	Pros	Cons
Joint aspiration	"Gold standard." WBC > 10,000 in up to 80% of septic joints in elderly. Can also demonstrate crystal arthropathies.	Invasive. Gram's stain is positive in less than 80%. Negative culture does not rule it out.
Blood cultures	Positive in 24-50% of cases.	Added cost. Not helpful if negative.
X-ray	Helpful if bony erosion or effusion seen.	If negative, not helpful.

Osteomyelitis[148]

Test	Pros	Cons
X-ray	May see soft tissue swelling, blurring of fascial planes, or periosteal reaction.	Nonspecific. Periosteal reaction is a late finding (10 days to 8 wks).
ESR	Abnormal in 80%.	Nonspecific. Normal value does not rule it out.
Blood cultures	Positive in 20-25% and may identify responsible bacteria.	Low yield. If negative, not helpful.

Bacteremia/Sepsis

Test	Pros	Cons
Blood cultures	May be the only clue that bacteremia exists. Sensitivity 99% if two separate cultures are drawn.[149]	Low yield if done improperly.
WBC	<5000 or >20,000 predictive of bacteremia in elderly.[33]	Nonspecific. Not helpful if normal.

Endocarditis

Test	Pros	Cons
Blood cultures	Positive in 85% of elderly with endocarditis.[49]	Nonspecific. Negative blood cultures do not rule out endocarditis.
TEE	Sensitivity > 90%.[47]	Invasive. Not always available in ED.
TTE	Readily available and noninvasive.	Detects vegetations in less than 50% of cases.[47]
EKG	May show signs of cardiac abscess—i.e., new conduction block or ischemia from coronary emboli.	Usually is normal.

Meningitis

Test	Pros	Cons
CT scan	Will be normal in meningitis but can diagnosis masses (i.e., abscesses), bleeding, and stroke.	May delay lumbar puncture (but not antibiotics!).
CSF	"Gold standard." May be obtained 1-2 hours after antibiotics given without CSF analysis changes.[141]	Invasive.

Nonspecific abdominal pain

Test	Pros	Cons
Plain film	May show complications—i.e., perforation, obstruction, or mass.	Generally low yield unless complicated disease.
Radionuclide-labeled WBCs	Very accurate at detecting localized infection.	Nonspecific and not readily available in most EDs.

(Continued on page 9)

setting of a fever should be aspirated and sent for Gram's stain, culture, cell count, LDH, pH, glucose, protein, and cytology. In general, sputum cultures are not useful in the initial evaluation of pneumonia,[38] unless tuberculosis or fungi are likely. However, blood cultures will be positive in up to 28% of pneumonia cases and may help guide inpatient therapy.[36,39] Consider PPD, fungal, and anergy panels when clinically indicated. While nasal cultures can be obtained if influenza virus is considered, these do not assist the emergency physician in the clinical diagnosis. Finally, an arterial blood gas can quantify hypoxemia or hypercarbia and may help determine the disposition. However, pulse oximetry is adequate to evaluate most patients with pneumonia who have no history of COPD.

Urinary Tract Infection

The diagnosis of UTI in the elderly patient can be difficult for several reasons. First, the elderly are prone to asymptomatic bacteriuria. Up to 34% of elderly women have asymptomatic bacteriuria at any one time. Some authorities believe that the majority of elderly women and many older men have at least one episode of asymp-

Table 11. Diagnostic Tests For Causes Of Fever In The Elderly Population. (continued)

CT	Readily available. May demonstrate other etiologies for fever.	Not 100% sensitive.
Biliary tract disease		
Test	**Pros**	**Cons**
Plain film	Cheap. May show emphysematous cholecystitis, porcelain gall bladder.	Demonstrates only 15% of gallstones. The presence of gallstones alone doesn't make the diagnosis. Should not be routine in evaluation of possible gall bladder disease.
Ultrasound	Nearly 100% sensitive for stones and 85% sensitive for cholecystitis with a trained operator.[151] Very specific. Shows signs of infection (thickened wall, sonographic Murphy's sign, pericholecystic fluid, distention). Also detects emphysematous, gangrenous, and perforated gall bladder.	Not as sensitive for acalculous cholecystitis (10% of cholecystitis in the elderly is acalculous).[150] 5-10% false-negative rate. Very operator dependent.
CT	Noninvasive and usually convenient. Good for common duct stones.	Less sensitive than ultrasound or HIDA scan. Usually not used for this indication.
Radionuclide (HIDA) scan	Sensitivity >90% for calculous and acalculous cholecystitis.[152] Very specific. Demonstrates biliary function.	Not as available as ultrasound. Takes longer.
Diverticulitis		
Test	**Pros**	**Cons**
Contrast enema	94% sensitive, with a 2-15% false-negative rate.[151]	Barium contraindicated in acute disease.
CT	Sensitivity 90-95% and specificity 72%. Positive predictive value 73%-100%. Good for the diagnosis of associated abscesses.[151]	For good results, requires late-generation machine and experienced radiologist.
Ultrasound	Sensitivity 54-89% and specificity 80-90%. Positive predictive value 76%.[151]	Operator-dependent.
Plain film	Cheap. Demonstrates appendicolith in 25% of cases.[153]	Very insensitive and not recommended.
Appendicitis		
Test	**Pros**	**Cons**
WBC	Approximately 80% of patients with appendicitis will have either leukocytosis or a left shift. (Plus, most surgeons will demand a CBC.)	Nonspecific and misleading—significant false-negative and false-positive rates.
C-reactive protein	Some studies report high sensitivity.	Wide range of reported sensitivity.[153] Best when drawn more than 12 hours after symptoms begin.
Radionuclide-labeled WBCs	Good results reported at some institutions. May detect other infections as well.	Takes a long time. Often not readily available.
Barium enema	High sensitivity and specificity (90-100%).[154]	High rate of non-diagnostic studies. Does not reveal other possible causes of pain/fever.
Ultrasound	Helpful in delineating gynecological etiology vs. appendicitis in females.	Operator-dependent. May be inconclusive due to overlying bowel gas. Less sensitive than CT.
CT	Very sensitive and specific if triple contrast is used. May show complications.	Not 100% sensitive; as a result, a negative study may give a false sense of security.

tomatic bacteriuria during their lifetimes.[73] Thus, an elderly patient presenting with bacteriuria and a fever presents a diagnostic dilemma: Is this a UTI or rather the presentation of pneumonia in a patient with coincident asymptomatic bacteriuria? For this reason, it is prudent to explore *all* potential sources for a fever before attributing it to the urinary tract.

Even the quantitative urine culture is not completely reliable. Definitive diagnosis of UTI has traditionally been defined as greater than 10^5 uropathogens / mL. This relatively arbitrary number was derived over 20 years ago based on studies of young women and does not uniformly apply to the elderly. Nearly one-third of patients with proven UTI have a bacterial count of less than 10^5 cfu / mL.[74,75] Some authorities propose that for symptomatic women or for patients with indwelling catheters, growth of 10^2 cfu / mL of a single bacterial pathogen is sufficient to diagnose UTI. For men, 10^5 cfu / mL is still the accepted standard, though some suggest it be lowered to 10^4 cfu / mL or even 10^3 cfu / mL.[73,78]

Other traditional markers of UTI, such as pyuria, leukocyte esterase, and nitrite, are also less reliable in the elderly patient. Pyuria is a poor predictor of bacteriuria; white cells are present in the urine of only 36-79% of elderly patients with UTIs.[74,79]

The method of obtaining urine for analysis is often as important as the specimen itself. Catheter specimens are preferred over midstream clean catch specimens in women. False-positive rates as high as 57% have been documented in elderly women when midstream specimens are compared with suprapubic aspiration.[79] Patients who present with an indwelling catheter should have the catheter changed before obtaining a urine sample. One study shows as many as one-quarter of specimens obtained from a chronic indwelling catheter misrepresent the true urine pathogens.[80]

Keeping these caveats in mind, the emergency physician should not hesitate to perform a urinalysis on any febrile senior. For elderly females with isolated lower tract symptoms and no comorbid conditions, a urinalysis alone will suffice. Obtain a creatinine level for females with any evidence of upper-tract disease. Obtain blood cultures in addition to urine cultures in patients with complicated infections. This would include those with indwelling Foley catheters, recent antibiotic treatment, or concurrent stone or stent. In men with any upper- or lower-tract symptoms, suspect urinary retention secondary to prostatic enlargement. Determine post-void residual by catheterization or by bladder sonogram.

Radiographic imaging of the urinary system is necessary in the ED if the emergency physician suspects the patient has an infected ureteral stone or stent, or in the case of suspected intrarenal or perinephric abscess. Consider perinephric abscess in patients with persistent fever and bacteriuria despite appropriate treatment; it is particularly likely in diabetics. Other renal imaging is generally deferred to the consultant. The goal of imaging studies is to identify any surgically correctable abnormalities of the urinary tract—urinary tract obstruction or intrarenal or perinephric abscess. Renal ultrasound reliably detects hydronephrosis associated with obstruction, while an abdominal CT with intravenous contrast best defines an intrarenal or perinephric abscess.

Indwelling Catheters

The emergency physician should strongly suspect a urinary source in any febrile elderly patient with an indwelling catheter, as two-thirds of these febrile episodes are caused by UTI.[81] The use of indwelling catheters is the single most important risk factor for the development of urinary tract infections in the institutionalized elderly.[82] Despite this fact, their use is ubiquitous; at any given time, more than 100,000 patients in U.S. nursing homes have an indwelling urethral catheter.[83] Catheterized patients develop bacteriuria at a rate of 3-10% per day, making bacteriuria a nearly universal finding in patients catheterized for longer than one month.[84] As a result, it is important to search for other causes of fever in this population before automatically attributing it to a UTI. On the other hand, chronic bacteriuria can lead to fever, UTI, pyelonephritis, and urosepsis. It is estimated that 2-4% of patients with bacteriuria develop bacteremia. Other febrile complications associated with long-term catheterization include chronic pyelonephritis, urethritis, epididymitis, scrotal abscess, prostatitis, and prostatic abscess.[85]

Abdominal Infections

For the febrile elderly patient with abdominal findings, a CBC with differential, liver function tests, amylase, and lipase may be helpful. Given the incidence of atypical presentations and increased morbidity and mortality in the elderly, the emergency physician should maintain a low threshold for radiological imaging. Obtain a right upper quadrant ultrasound if cholecystitis is considered. The diagnosis of diverticulitis is generally made clinically, though complications such as obstruction and abscesses are best seen on CT. Radiocontrast enema may actually exacerbate acute diverticular disease, and physicians should employ a water-based contrast medium if the process is used at all. Helical CT using triple contrast (oral, rectal, and intravenous) is becoming an important diagnostic tool in the evaluation of appendicitis, demonstrating accuracy rates of 98%.[86]

Treatment Of The Febrile Senior

Rapid institution of empiric antibiotic therapy is the cornerstone of ED treatment of the infected elder. It is clear that the consequences of a delay in diagnosis or treatment are much more grave in this population. **Table 12** (on page 11) outlines suggested empiric antibiotic therapies for the most common infections in the elderly.

Antimicrobial Considerations In The Elderly

A pill for every ill, an ill from every pill. Proper antibiotic selection is particularly important in the elderly patient for a multitude of reasons. The incidence of adverse drug

effects is 1.5-3.0 times higher in older patients.[87] (See **Table 13**.) Practically every pharmacokinetic parameter is altered in geriatric patients, including absorption, distribution, metabolism, and excretion. Because creatine clearance decreases an average of 10% per decade of life after age 20,[88] all elderly have some degree of renal insufficiency—an important consideration when selecting an antimicrobial agent.

Antibiotic choice is directed by several factors, including the suspected organ system involved. Table 12 lists the most common pathogens associated with various sites of infection. Note that geriatric patients are not only prone to a different spectrum of pathogens than younger patients, infections are also more likely to be polymicrobial. Thus, broad-spectrum antibiotics are usually indicated. Pharmacodynamics, side effect profiles, and compliance are also important considerations. The elderly have a high rate of noncompliance,

Table 12. Empiric Antibiotic Selection For Common Infections In The Elderly.

Bacteremia/Sepsis (no obvious source)

Modifying circumstances	Predominant organisms	Suggested regimen	Alternative regimen
Adult, non-immunocompromised	*Enterobacteriaceae,* Group A or D *Streptococcus, S. pneumoniae, "Bacteroides", E. coli, S. aureus*, coagulase-negative *Staphylococcus*, *Klebsiella* sp.	Ceftizoxime +/- aminoglycoside; or ampicillin + aminoglycoside + clindamycin; or Imipenem	Metronidazole for clindamycin, Aztreonam for aminoglycoside

Pneumonia

Modifying circumstances	Predominant organisms	Suggested regimen	Alternative regimen
Community-acquired	*S. pneumoniae* 20%-60%, *H. influenzae* 3%-10%, *Legionella pneumoniae* 2%-8%, *Mycoplasma* 2%-37%, Polymicrobial	New-generation quinolone; or macrolide +/- second- or third-generation cephalosporin	Imipenem
Community-acquired—Intensive care necessary	See above	Macrolide or fluoroquinolone + cefotaxime or ceftriaxone; or beta-lactam/beta-lactamase inhibitor	Macrolide + antipseudomonal agent (imipenem/cilastatin or ciprofloxacin)
Institutionalized (Nosocomial)	*Klebsiella pneumoniae*, *Pseudomonas* sp., *E. coli, S. pneumoniae*	Ceftazidime or antipseudomonal PCN + aminoglycoside	Ciprofloxacin for antipseudomonal PCN, aztreonam for aminoglycoside

Urinary tract (not sepsis)

Modifying circumstances	Predominant organisms	Suggested regimen	Alternative regimen
Institutionalized, indwelling catheter, outlet obstruction, or upper tract symptoms	*E. coli, Proteus* sp., *Klebsiella* sp., *Pseudomonas* sp., *Enterococcus, S. epidermidis;* often polymicrobial	Ampicillin and gentamicin or piperacillin-tazobactam or imipenem	Fluoroquinolone, or aztreonam, or third-generation cephalosporin
None	*E. coli*	Fluoroquinolone or TMP-SMX (resistance to TMP-SMX is increasing)	First-generation cephalosporin or doxycycline or amoxicillin/clavulanate

Skin/Soft tissue

Modifying circumstances	Predominant organisms	Suggested regimen	Alternative regimen
Cellulitis or erysipelas	Group A *Streptococcus, S. aureus*	Dicloxacillin or nafcillin cephalosporin	Erythromycin or amoxicillin/clavulanate
Pressure sore with systemic infection	Polymicrobic: anaerobic *Streptococci, Enterobacteriaceae, Pseudomonas* sp., *Bacteroides*	Amoxicillin/clavulanate, Cefoxitin + aminoglycoside, imipenem, or ampicillin/sulbactam	Ciprofloxacin and clindamycin

Influenza

Modifying circumstances	Predominant organisms	Suggested regimen	Alternative regimen
Treat if seen less than 24-48 hours after onset of symptoms; prophylaxis after exposure	Influenza A	Amantadine or rimantadine and influenza vaccine (0.5 mL IM)	

Adapted from: Rhyne RL, Roche RJ. Infection in the elderly. In: Brillman JC, Quenzer RW, eds. *Infectious Disease in Emergency Medicine*, 2nd ed. Philadelphia: Lippincott-Raven; 1998:291-316.

which is in no small part due to complex dosing regimens. Once or at most twice a day dosing is preferred for outpatient treatment.

Penicillins and cephalosporins are generally the antibiotics that are best tolerated and have the least incidence of side effects in the elderly. Aminoglycosides have excellent activity against many gram-negative organisms but have the risk of ototoxic and nephrotoxic side effects. When used, aminoglycosides should be adjusted for the patient's diminished renal function. Once-daily dosing of gentamycin using the Hartford nomogram can decrease both toxicity and costs while possibly improving outcomes over traditional regimens.[125-127] Nitrofurantoin should be avoided as it strongly associated with adverse reactions in the elderly.

The presence of "hardware" such as a central line or a prosthetic valve or joint increases the risk for methicillin-resistant *Staphylococcus aureus* and should trigger consideration of vancomycin in addition to other antimicrobials.

Pulmonary Infections

Once the diagnosis of pneumonia has been made, promptly administer antibiotics. The sooner the treatment is initiated, the lower the mortality and morbidity.[38,40,89] The Clinical Pathway "Evaluation Of Fever In The Elderly Patient" on page 14 outlines the decisions leading to admission and parenteral antibiotic therapy in this population. For inpatients, give the first dose before transfer to the in-hospital bed; for outpatients, the first antibiotic dose (oral or parenteral) should be given in the ED before discharge. (For more information on the treatment of pneumonia, see the September 1999 issue of *Emergency Medicine Practice*, "Community-Acquired Pneumonia: Deciding Whom To Admit And Which Antibiotics To Use.")

The most recent generation of fluoroquinolones (such as levofloxacin or sparfloxacin) and the extended-spectrum macrolides (such as azithromycin or clarithromycin) provide excellent coverage of both typical and "atypical" organisms. These agents are useful for both inpatient and outpatient therapy. Patients ill enough to require intensive care may be treated with a macrolide or new-generation fluoroquinolone in combination with a third-generation cephalosporin (such as cefotaxime or ceftriaxone) or a beta-lactam / beta-lactamase inhibitor (such as ampicillin / sulbactam, ticarcillin / clavulanate, or piperacillin / tazobactam).

If influenza virus is suspected, amantadine or rimantadine can be given. However, these drugs are only effective against influenza A.[90] Because confusion is a common side effect of amantadine in the elderly, reduce the dose by half.[91]

Urinary Tract Infections

Several studies have substantiated the use of short-course (3-day) oral therapy for elderly women with isolated

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Table 13. Common Antibiotic Interactions In The Elderly.[16,19,135]

Antibiotic	Comment
Carbenicillin Ampicillin TMP/SMZ Cephalosporins (e.g., Cefotetan, Cefoperazone) Erythromycin Metronidazole Fluconazole	High sodium content, can exacerbate CHF Increase anticoagulant effect of warfarin
Rifampin	Decreased anticoagulant effect of warfarin
Sulfonamide Chloramphenicol TMP/SMZ	Predisposes to hypoglycemia with oral hypoglycemics
Erythromycin Clarithromycin Tetracycline TMP/SMZ	Digoxin toxicity
Amphotericin B Erythromycin Ciprofloxacin Enoxacin	Hypokalemia, may precipitate Digoxin toxicity Theophylline toxicity
TMP/SMZ	Bone marrow suppression with methotrexate
Aminoglycosides	Increased ototoxicity with ethacrynic acid

Clinical Pathway: Treatment Of The Elderly Patient With Pneumonia

Diagnosis of pneumonia

↓

Are there any comorbid conditions?
- CHF, CVA, renal or hepatic failure, or cancer (Class IIa)
- COPD or chronic steroids (Class IIb)

→ Yes

↓ No

Has there been any significant acute change in mental status (Class IIa); or does the patient suffer from chronic dementia? (Class IIb)

→ Yes

↓ No

Are there any physical findings associated with increased mortality? (i.e., pulse ox < 90%, RR>30, HR>125, BP < 90, temperature: < 35˚C or > 40˚C.) (Class IIa)

→ Yes

↓ No

Are there any diagnostic findings associated with increased mortality? (i.e., PaO_2 < 60, pH < 7.35, BUN > 30, Hct < 30, Na < 130 mEq/L, glucose > 250 mg/dL (Class IIa) WBC < 4000 or > 30,000, ANC < 1000, $PaCO_2$ > 50) (Class IIb)

→ Yes

↓ No

Is this a relaible patient who has good social support and close follow-up?

→ Yes

↓ No

Consider admission for parenteral antibiotics. (Class IIb) For formal PORT (Pneumonia Outcomes Research Team) scoring system and further discussion of this issue, see the September 1999 issue of *Emergency Medicine Practice* on community-acquired pneumonia.

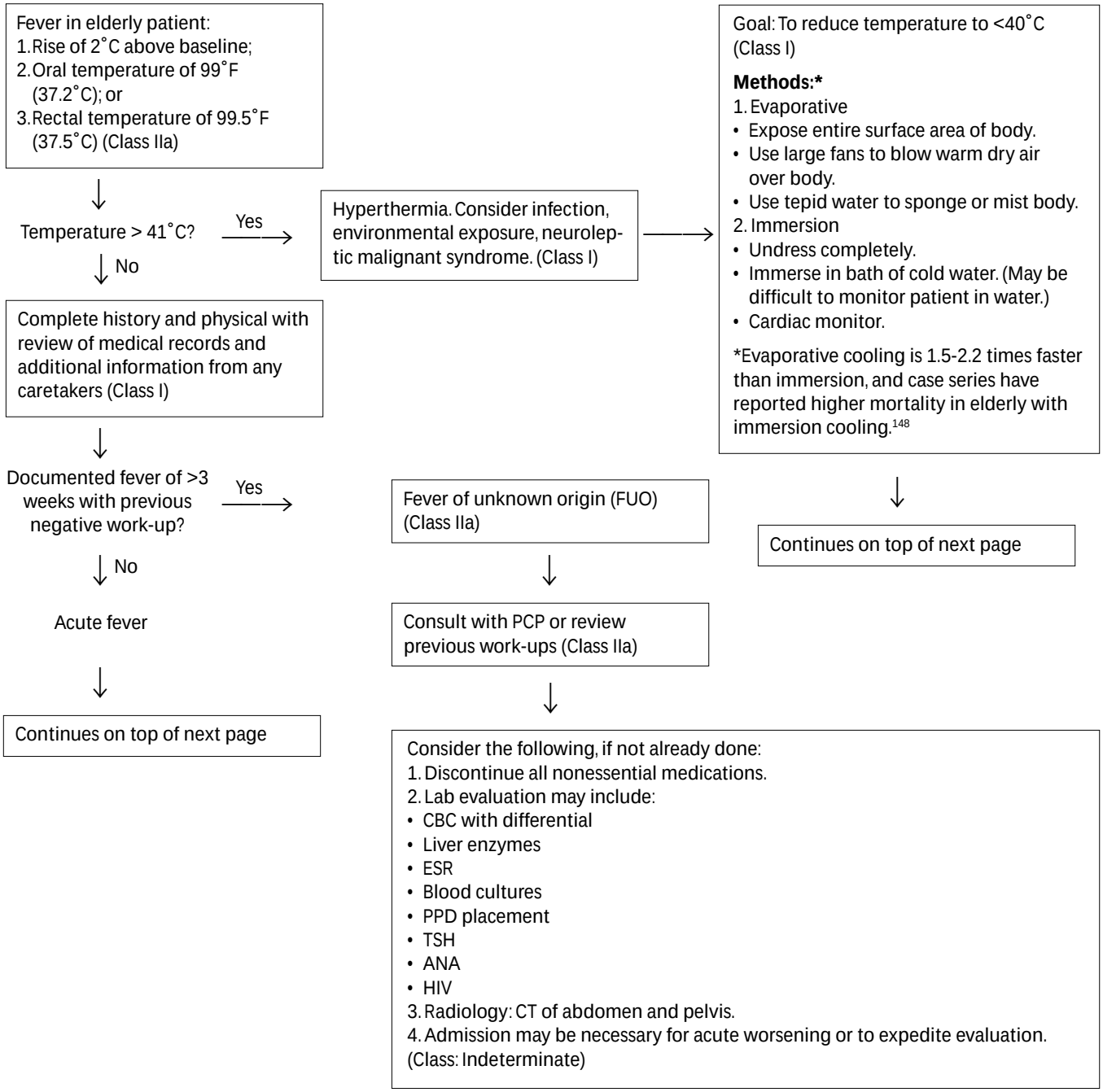
Consider admission for parenteral antibiotics. For formal PORT (Pneumonia Outcomes Research Team) scoring system and further discussion of this issue, see the September 1999 issue of *Emergency Medicine Practice* on community-acquired pneumonia.

Consider outpatient therapy with follow-up in 3-4 days. (Class IIb)

The **evidence for recommendations** is graded using the following scale. For complete definitions, see back page.
Class I: Definitely recommended. Definitive, excellent evidence provides support.
Class IIa: Acceptable and useful. Very good evidence provides support.
Class IIb: Acceptable and useful. Fair-to-good evidence provides support.
Class III: Not acceptable, not useful, may be harmful.
Indeterminate: Continuing area of research.

This clinical pathway is intended to supplement, rather than substitute, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

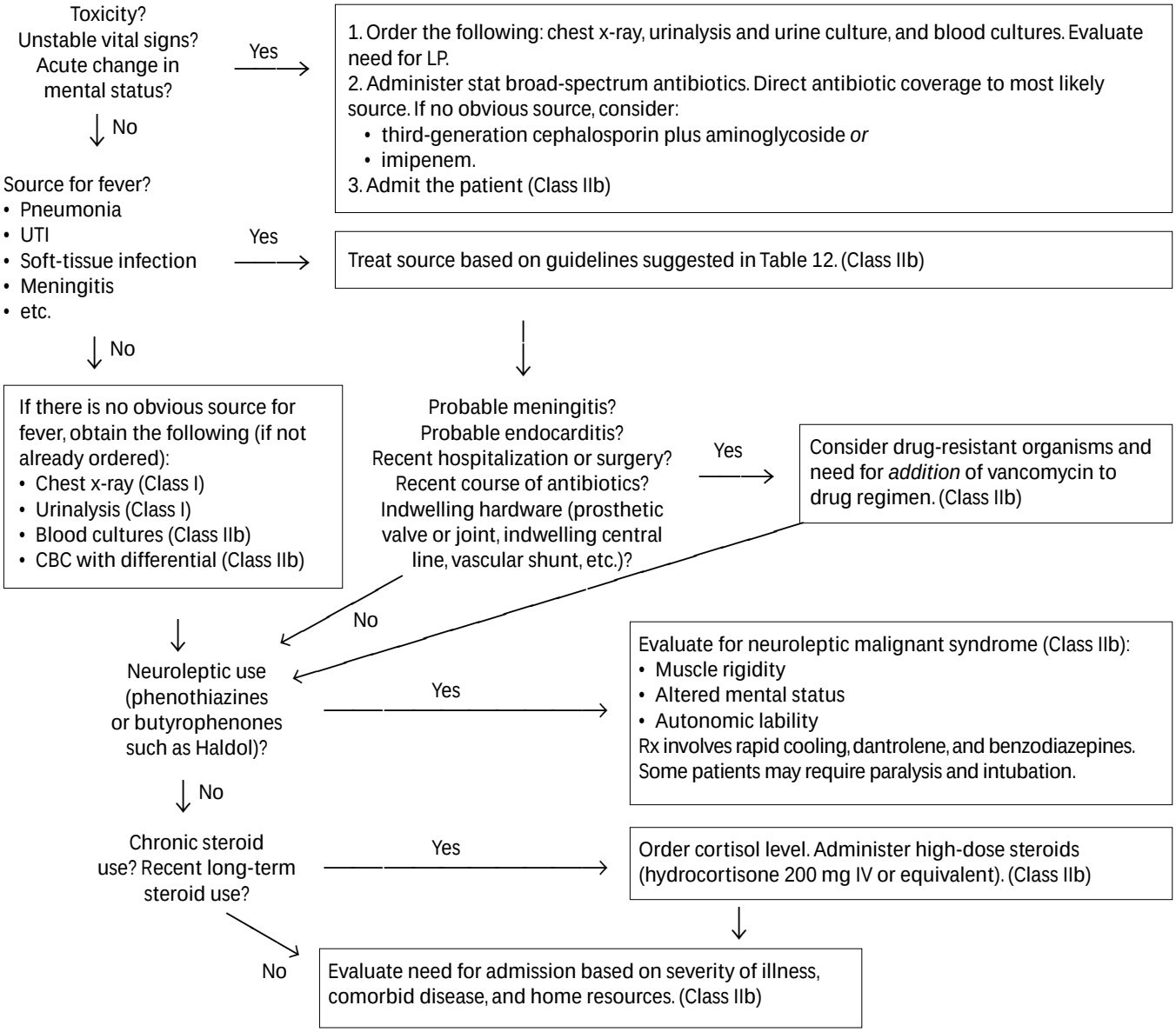
Clinical Pathway: Evaluation Of Fever In The Elderly Patient



The **evidence for recommendations** is graded using the following scale. For complete definitions, see back page.
Class I: Definitely recommended. Definitive, excellent evidence provides support. **Class II a:** Acceptable and useful. Very good evidence provides support. **Class II b:** Acceptable and useful. Fair-to-good evidence provides support. **Class III:** Not acceptable, not useful, may be harmful. **Indeterminate:** Continuing area of research.

This clinical pathway is intended to supplement, rather than substitute, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Clinical Pathway: Evaluation Of Fever In The Elderly Patient (continued)



The **evidence for recommendations** is graded using the following scale. For complete definitions, see back page.
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This clinical pathway is intended to supplement, rather than substitute, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Continued from page 12

lower urinary tract infection, though some experts still advocate a seven-day course.[92,93] Indwelling catheters predispose to colonization by multiple organisms and multidrug resistance.

An upper tract infection should be suspected in the patient who has any combination of high fever, new mental status changes, toxicity, flank tenderness, or granular casts in the urine. An upper tract infection is also likely in patients who do not substantially improve after 72 hours on oral antibiotics.

As with any febrile elder, a low threshold for admission is necessary for those with urinary tract infections. All older patients with evidence of acute pyelonephritis require admission. Elderly patients with pyelonephritis are much more likely to have bacteremia and urosepsis than their younger counterparts. UTI is the most common cause of bacteremia in older adults—of those with pyelonephritis, 66% will develop bacteremia, and up to 22% of elderly women with pyelonephritis develop sepsis.[94-96] Rapid institution of parenteral antibiotics is indicated in patients with signs of toxicity.

For outpatients, fluoroquinolones are an excellent choice. While TMP-SMX is frequently prescribed, increasing bacterial resistance is a growing concern, especially on the West Coast. While there are local variations in antibiotic susceptibility, more than 15% of common urinary pathogens are resistant to ampicillin, cephalothin, and trimethoprim / sulfamethoxazole.[97] Patients with upper tract disease and those with urosepsis may benefit from a combination of ampicillin or ceftriaxone plus an aminoglycoside, or a high-dose fluoroquinolone. A beta-lactam / beta-lactamase inhibitor such as ampicillin / sulbactam may also be effective.

Infection co-existent with an obstruction is a urological emergency and may require cystoscopy or surgery to remove the stone. Perinephric abscesses usually require percutaneous or open surgical drainage, whereas intrarenal abscesses can usually be managed with prolonged antibiotic therapy.

Abdominal Infections

Optimal treatment of cholecystitis and appendicitis consists of hemodynamic stabilization, empiric antibiotic therapy, and early surgical intervention. Uncomplicated diverticular disease is usually managed medically. Seventy percent of patients recovering from a bout of uncomplicated diverticulitis will have no recurrences regardless of medical or surgical management.[98] Mild disease is treated on an outpatient basis with a high-fiber diet, usually in conjunction with oral antibiotics. Severe or complicated disease is treated on an inpatient basis with IV fluids, nasogastric suction, and empiric antibiotics.

Table 14. Diagnosis Of Fever Of Unknown Origin In The Elderly.

General classifications/Systems	Specific causes	Percent	Subtotal
Infection	Intraabdominal Abscess	12%	35%
	Tuberculosis	6%	
	Infective endocarditis	10%	
	Other	7%	
Collagen vascular diseases	Temporal arteritis	19%	28%
	Polyarteritis nodosa	6%	
	Other	3%	
Neoplasms	Primary tumors	9%	19%
	Lymphomas/Hematologic cancer	10%	
Neurologic	Degenerative CNS disorder		9%
	Sarcoid meningitis		
Hemolytic	Hemolytic disease		
Cardiopulmonary	Thrombophlebitis		
	Pulmonary embolism		
Gastrointestinal	Inflammatory bowel disease		
	Alcoholic hepatitis/cirrhosis		
	Granuloma hepatitis		
Rheumatologic	Still's disease		
Endocrine	Pheochromocytoma		
	Hyperthyroid		
Pharmacological	Drug fever		
Psychogenic	Factitious		
	Unknown	9%	9%

*Percents adapted from: High KP. Infection in the elderly. In: Hazzard WR, Blass JP, Ettinger WH, et al, eds. *Principles of Geriatric Medicine and Gerontology,* 4th ed. New York: McGraw-Hill; 1998:1443-1454.

Treatment Of Fever

Numerous animal experiments show that fever can be a protective response during bacterial infection.[99] Although there have not been any clinical trials regarding the benefit of fever in the elderly, some pneumonia studies demonstrate a higher mortality rate in afebrile elderly patients.[100] There is also evidence that antipyretic treatment may have an adverse effect on the immune system.[101]

On the other hand, fever itself can be detrimental to elderly patients. It can be the source of mental status changes, worsen cardiopulmonary disease, and predispose to dehydration. With every degree Celsius increase, there is a 13% increase in oxygen consumption and heightened caloric and fluid requirements.[102] This increase in basal metabolic rate elevates the heart rate as well—a significant stressor for the elderly person with COPD or unstable angina. In general, fever in the elderly is treated with antipyretics, acetaminophen being a safe and effective choice.

Special Considerations

The Immunocompromised Elderly

In addition to the immune senescence attributed to aging, many elderly are further immunocompromised by underlying illness. For example, an estimated 20% of people over age 75 have diabetes mellitus,[103] while 47% of patients with renal failure are over 65 years of age.[104] Even 10% of all AIDS cases diagnosed in the United States occur in people over 50 years of age.[18] Other illnesses common in the elderly include cirrhosis, multiple myeloma, lymphomas, leukemias, and solid tumors. These patients are at higher risk for all types of infections, including gram-negative bacteremia and sepsis.

There are several febrile syndromes unique to the immunocompromised host. Malignant otitis externa is a life-threatening disease found almost exclusively in the elderly diabetic.[105] Spontaneous bacterial peritonitis, emphysematous cholecystitis, and fungemia are also more common in the immunocompromised. Given the high mortality associated with these syndromes, any febrile elderly patient with a potentially immunocompromising illness should be considered infected. In the majority of cases, early antibiotics and hospitalization will be appropriate.

Fever Of Unknown Origin

Fever of unknown origin (FUO) is classically defined as temperature higher than 38.3˚C on multiple occasions, lasting longer than three weeks without a diagnosis after one week of hospital investigation.[105] In the era of managed care, this has been changed from one week in the hospital to three days or three outpatient visits without a diagnosis.[105] The leading cause of FUO is infectious disease. (See **Table 14** on page 16.) If the patient has a documented FUO, consultation with the primary care provider (PCP) or review of medical records may direct further diagnostic work-up. Many of the results in the FUO evaluation are not readily available to the emergency physician, and follow-up should be facilitated with a PCP. Despite this, some causes of chronic fever, such as intraabdominal abscess, active tuberculosis, and endocarditis, are routinely diagnosed in the ED.

Non-infectious Life-Threatening Causes Of Fever In The Elderly

The vast majority of life-threatening fevers in the elderly are caused by infection. However, there are three dangerous conditions that produce hyperpyrexia that are *not* caused by microbes. These rare entities include heat stroke, salicylism, and neuroleptic malignant syndrome (NMS). (See **Table 15**.) Thyroid storm and sympathomimetic overdose are also occasional causes of life-threatening hyperpyrexia.

Altered mental status and high temperatures

Table 15. Non-infectious Life-Threatening Causes Of Fever.

Condition	Diagnostic Clues	Treatment
Heat stroke[129]	Temperature usually 103˚F or higher Altered mental status Epidemics seen during heat waves Presence or absence of sweating not diagnostic	Rapidly cool patient. (See page 14.) Target a rectal temperature of 101˚F within 30 minutes of treatment. Benzodiazepines may be necessary to prevent shivering. Antipyretics not indicated.
Salicylism[130]	History of aspirin use Patient may complain of tinnitus Altered mental status Chest x-ray may demonstrate ARDS Acid-base disturbance (respiratory alkalosis early, metabolic acidosis later) Positive ferric chloride urine test High serum salicylate level	Rapidly cool patient. Alkalinize urine with D_5W with 3 ampules of sodium bicarbonate. Begin drip at 150-cc/hour and target urine pH of 7.5. Add 40 meq KCl/L. Monitor serum electrolytes. Consider dialysis for renal failure, persistent acidemia, pulmonary edema, deterioration despite supportive care, or severe mental status changes or coma, in the aged with comorbid disease.
Neuroleptic malignant syndrome (NMS)[131]	History of phenothiazine or butyrophenone use High temperatures (usually 103˚F or higher) Altered mental status Muscle rigidity Autonomic instability (fluctuating heart rate and blood pressure)	Rapidly cool patient. Administer Dantrolene 1-3 mg/kg q6h. Some authorities recommend bromocriptine 2.5-10 mg po q8h. Administer benzodiazepines for muscle rigidity. Patients with refractory condition may require paralysis and intubation.

(usually over 103˚F) characterize all of these conditions. While the emergency physician should consider heat stroke, salicylism, and NMS in the confused and febrile senior, sepsis and meningitis are far more common. For this reason, be aggressive with antibiotics in such patients while investigating possible non-infectious etiologies.

Controversies/Cutting Edge

Vaccines In The ED

Vaccination in the ED is usually limited to tetanus and rabies post-exposure prophylaxis. The elderly are less likely to have protective titers for tetanus, even if they have received the vaccine in the past.[18] While the elderly are the group most at risk for tetanus (they represent almost 50% of all tetanus cases), they are least likely to receive a booster.[16,65]

Although the pneumococcal vaccine is indicated for all persons 65 and older, only 19-28% of those eligible receive the vaccine.[104,105] Pneumococcal vaccine in the elderly is cost-effective and saves lives.[107] More recently, a retrospective analysis demonstrated that an ED-based pneumococcal vaccine program could decrease morbidity, mortality, and hospital costs.[108] Equally important, it is logistically feasible in the ED.[109] Other vaccines may expand the role of the ED in providing preventative medical care.[110]

Influenza

While influenza is not necessarily more common in the elderly, the morbidity and mortality are much greater.[38] The elderly are 20 times more likely to be hospitalized and 10 times more likely to develop bacterial pneumonia after a bout of influenza.[111] Although vaccination can reduce mortality by up to 60%, many patients remain unimmunized.[112] The diagnosis of influenza is clinical; however, rapid detection methods are becoming more readily available.[113,114]

Currently there are two drugs used for the treatment of influenza A (not influenza B)—amantadine and rimantadine. Both have pronounced CNS side effects in the elderly. More treatments for both influenza A and B are expected to be available in the near future.[115,116] Rapid laboratory diagnosis and additional treatment options will dramatically impact the way emergency physicians manage influenza.

Disposition

The decision to admit or discharge a given patient may be complex. Obviously any patients with sepsis, dehydration, hypoxemia, or an inability to take oral medications should be admitted. In addition, frail patients or those with significant underlying disease also may

Ten Excuses That Don't Work In Court

1. "The patient belonged to Dr. Jones. I thought Dr. Jones should choose the antibiotics."

Patients do not "belong" to doctors; doctors serve at the pleasure of the patient. The foremost duty of the emergency physician is to the patient—not to a private attending. If the emergency physician suspects a serious bacterial infection, antibiotics should be started as soon as possible. Delayed antibiotic treatment results in higher morbidity and mortality.[38,117]

2. "Yes, I knew she had a fever of 103˚F, but her white count and chest film were normal. She didn't have a 'ticket' for admission."

No ticket? You almost "punched her ticket"! Rather than asking why a febrile elderly patient should be admitted, instead ask why they *should not* be admitted. One study demonstrated a 76% incidence of serious illness and an 18% incidence of bacteremia in febrile elderly patients.[5] The study also noted that 13.8% of febrile patients discharged required subsequent admission for their fever. If the febrile senior appears well enough to go home, arrange a recheck in the ED or with the PCP the next day.

3. "I thought he just had a cold."

Viral syndrome is a diagnosis of exclusion in the elderly—always think *"bacteria."* Emergency physicians correctly predict bacteremia in less than two-thirds of elderly patients. In reality, viruses cause less than 5% of infection-related fevers in the elderly. The viral syndromes they develop may be fatal, as in the case of influenza and subsequent respiratory failure.

4. "But he didn't come to the ED because he was sick—he fell and needed sutures!"

Well, you should have checked his temperature—after all, it is called a *vital* sign. It turns out the laceration was the least of this patient's problems—it was the overlooked urosepsis that killed him. Remember that acute functional decline—falls, confusion, weakness, and lethargy—may be the only clues to a life-threatening infection. Infections account for at least 75% of all episodes of acute functional decline in nursing home patients.

5. "She didn't really have a fever. Her temperature was only 100.9˚F."

It was a fever. The older *are* truly colder. They not only have a lower baseline temperature, they also frequently demonstrate a blunted fever response to proven bacterial infection. Furthermore, in the presence of infection, patients with hypothermia do worse than those with fever.

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benefit from hospitalization.

The patient's living situation, functional status, and the availability of home and community resources also affect this decision. In many cases, the pendulum swings to admission—a decision well-supported in the literature. Several studies propose that 76-90% of febrile patients over the age of 60 have an illness serious enough to warrant admission![4,5] Other studies demonstrate that the febrile elderly patient has an 18-35% likelihood of bacteremia or a focal bacterial infection.[5,117,118] Community-acquired bacteremia in the elderly patient carries a sobering 38% mortality rate.[119] These statistics justify a liberal admission policy for the elderly. The threshold for admission should also be lowered for the febrile elderly patient with an unclear diagnosis.

An alternate perspective is that the hospital may be a dangerous place for the elderly. As Samuel Goldwyn pronounced, "A hospital is no place to be sick." Nosocomial infection is a significant possibility, and the unfamiliar environment may lead to confusion and injury. Immobilization in the hospital bed may promote pneumonia, decubitus ulcers, and pulmonary embolus.

Several safeguards should be in place for the discharged patient. If the patient is being returned to a nursing home, write specific orders including monitoring parameters, antibiotic delivery, and follow-up. Specify under what conditions a physician should be called. When possible, discuss the outpatient plan and follow-up with the patient's primary physician. Patients being discharged home should receive explicit discharge instructions and close follow-up. One study of elderly patients discharged from the ED demonstrated that 20% of patients were actually worse at follow-up.[120] The services of a social worker in the ED may be invaluable. The worker may assess the patients' functional status and social supports and help arrange home health visits.

Summary

The percentage of elderly patients presenting to EDs will continue to provide some of the greatest challenges to our profession. The high incidence of atypical presentations in the elderly, the close association of fever with bacterial infection, the prevalence of chronic disease, and an aging immune system all mandate special care in dealing with this fragile population.

There are several key principles that direct the care of the geriatric patient: Serious disease may occur despite a relatively benign exam; functional decline may be the only clue to grave infection; and temperature elevations may be marginal. The emergency physician should always consider pneumonia, urinary tract, and soft-tissue infections in the

Ten Excuses That Don't Work In Court (continued)

6. "The family never told me that their grandmother had decubiti!"

This excuse will not fly. It's our job to perform an adequate examination. This means we need to undress the patient completely. Turn the patient over, and scrutinize the sacral prominence and the heels, especially in patients who are bedridden. Sepsis associated with pressure sores carries a mortality of 50%![72,118]

7. "I couldn't get any history from him. He was a confused old guy who didn't know why he was in the ED."

He had good reason to be confused, what with bilateral pneumonia. It's a common mistake to assume that the confused 80-year-old is "just demented," when in fact he or she may be a normally intact and independent person with acute delirium secondary to sepsis. In such cases, it's important to review the old chart and talk to family members, caretakers, and the private physician.

8. "I know she had fever and belly pain. But her abdomen wasn't *that* tender!"

Abdominal pain in the elderly often represents serious pathology. Nearly one-third of elderly patients who present with a surgical emergency have no significant abdominal tenderness—estimated at up to 25% in cholecystitis, 34% in appendicitis, and 13-30% in diverticulitis. Be liberal in diagnostic testing and/or surgical consultation. Ultrasound may demonstrate cholecystitis (the most common surgical emergency in the elderly), while triple-contrast CT can diagnose acute appendicitis with great accuracy.

9. "I was sure that he had a UTI. He had a fever, and the drainage from his Foley catheter looked nasty."

Unfortunately, the patient had pneumonia, unresponsive to the sulfa medication he was prescribed. Patients with an indwelling catheter always have "nasty" urine—many have chronic pyuria and polymicrobial colonization. Do not assume that the urine is always the source of a fever. If no other cause, such as pneumonia or soft-tissue infection, is apparent, change the catheter before obtaining a urine sample. One study shows as many as one-quarter of specimens obtained from a chronic indwelling catheter misrepresent the true urine pathogens.

10. "But the CBC was normal."

Even the jury knows this is a ridiculous defense. The CBC is not sensitive to bacterial infection. More than 30% of bacteremic patients have a normal leukocyte count.[121] However, an elevated leukocyte count in the febrile senior *is* significant. In one small study, 36% of febrile adults over the age of 50 with a WBC count of 15,000 or higher had a serious illness.[122]

differential diagnosis. Use laboratory and radiographic tests liberally, and maintain a low threshold for admission. When discharging an elderly patient with fever, always ensure close follow-up. Administer antibiotics early! With these principles in mind, emergency physicians will more successfully navigate the turbulent waters of geriatric infectious disease. ▲

References

Evidence-based medicine requires a critical appraisal of the literature based upon study methodology and number of subjects. Not all references are equally robust. The findings of a large, prospective, randomized, and blinded trial should carry more weight than a case report.

To help the reader judge the strength of each reference, pertinent information about the study, such as the type of study and the number of patients in the study, will be included in bold type following the reference, where available. In addition, the most informative references cited in the paper, as determined by the authors, will be noted by an asterisk (*) next to the number of the reference.

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Cost-Effective Strategies For Managing Fever In The Elderly

1. Use home therapy as an alternative to hospitalization.
The decision to admit or discharge a patient is the single most expensive decision an emergency physician makes. In selected patients, home therapy may be a safe and cost-effective alternative to hospitalization. A visiting nurse may administer antibiotics with a long half-life such as ceftriaxone or levofloxacin, on a once- or twice-a-day schedule. Skilled nursing homes may also provide intravenous antibiotics.

Risk Management Caveat: Home healthcare requires close involvement with a primary care physician. The program must be well-run and have a quality assurance program to evaluate outcomes.

2. Obtain urine cultures and not blood cultures for patients with pyelonephritis.
In several studies regarding *uncomplicated* pyelonephritis, blood cultures either never demonstrated an organism that was not detected by the urine culture or never had an impact on therapy.[123,124]

Risk Management Caveats: 1. Make sure the patient indeed has pyelonephritis. They should have significant pyuria (more than just a few white cells in the urine) and no competing diagnosis such as soft-tissue infection or pneumonia. 2. The patient must have uncomplicated pyelonephritis. Complicated pyelonephritis includes patients with an indwelling Foley, ureteral stents or stones, or a partially treated UTI.

3. Use once-a-day dosing for aminoglycosides.[125-127]
The Hartford nomogram allows for once-a-day administration of gentamycin or tobramycin. The initial dose in the elderly is 4 mg per kilogram, and subsequent dosages are timed based on the patient's creatinine clearance. The regimen reduces costs because it eliminates the need to measure peak and trough drug levels and decreases the costs associated with multiple drug dosing, such as nursing time, pharmacy costs, supplies, and so on. Most studies have found the Hartford nomogram to be less ototoxic and nephrotoxic than traditional aminoglycoside dosing, and at least (if not more) effective in outcome.

Risk Management Caveat: The once-a-day dosing is not adequate for patients with enterococcal infections. In addition, many healthcare providers may be unaware of this dosing strategy and may be stunned by what they perceive to be an aminoglycoside overdose. If the emergency physician intends to use the Hartford nomogram, we must educate the nurses and private attendings to avoid shocking their therapeutic sensibilities.

4. When possible, order high-yield specific tests rather than vague markers of inflammation.
Sometimes when faced with diagnostic uncertainty, we fire blindly into the bushes hoping to hit some unseen target. Instead, be an emergency medicine sniper. Febrile patients with a headache and altered mental status do not need an ESR or CRP—they need a Gram's stain and cell count performed on their CSF. A urate level, ANA, and even a CBC are useless in the face of a painful joint. Only an arthrocentesis will do. If there is no evidence of a localized infection on physical examination, a chest x-ray, urinalysis, and blood cultures will identify more than 70% of the causes of infection in the elderly.[5]

Risk Management Caveat: Some febrile seniors will have no identifiable source of infection. If such patients are not admitted, they must receive early follow-up with their primary care physician or with a scheduled re-examination in the ED.

5. Sometimes you have to spend money to save money.
While the CT scanner appears to be an expensive means of evaluating abdominal pain, in the end it may be more cost-effective than dozens of less informative tests and prolonged or needless observation. At least one well-designed study demonstrated that computed tomography saves significant hospital resources in the case of suspected appendicitis.[128]

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Physician CME Questions

37. All of the following medications can inhibit heat dissipation and increase risk of hyperthermia *except:*
a. Lithium
b. Thyroid hormone
c. Amitriptyline
d. Diltiazem

38. Elderly patients represent what percentage of tetanus cases?
a. 5%
b. 15%
c. 35%
d. 50%

39. The most common cause of fever of unknown origin is:
a. neoplasm.
b. infection.
c. collagen vascular disease.
d. drug fever.

40. Which of the following interventions has been found to reduce morbidity in the elderly patient with pneumonia?
a. Blood cultures
b. Early administration of antibiotics
c. Reduction of fever
d. Admission to ICU or step-down unit

41. Fever in an elderly person presenting to the ED is most likely associated with:
a. viral infection.
b. stroke.
c. bacterial infection.
d. thyroid disease.

42. The three most common infectious syndromes in the elderly are:
a. Soft tissue infections, appendicitis, septic arthritis
b. Pneumonia, endocarditis, urinary tract infections
c. Pneumonia, urinary tract infections, soft-tissue infections
d. Influenza, urinary tract infections, meningitis

43. Which of the following antibiotics should be avoided in the elderly?
a. Nitrofurantoin
b. Cephalosporins
c. Penicillin
d. Erythromycin

44. Roughly what percentage of elderly women have asymptomatic bacteriuria at any given time?

a. 5%
b. 12%
c. 70%
d. 35%

45. What is the mortality rate of community-acquired bacteremia in the elderly?

a. 38%
b. 15%
c. 62%
d. 5%

46. Which disease is *not* seen with greater frequency in the elderly?

a. Acalculous cholecystitis
b. Appendicitis
c. Diverticulitis
d. Otitis externa

Class Of Evidence Definitions

Each action in the clinical pathways section of *Emergency Medicine Practice* receives an alpha-numerical score based on the following definitions.

Class I
- Always acceptable, safe
- Definitely useful
- Proven in both efficacy and effectiveness
- Must be used in the intended manner for proper clinical indications

Level of Evidence:
- One or more large prospective studies are present (with rare exceptions)
- Study results consistently positive and compelling

Class IIa
- Safe, acceptable
- Clinically useful
- Considered treatments of choice

Level of Evidence:
- Generally higher levels of evidence
- Results are consistently positive

Class IIb
- Safe, acceptable
- Clinically useful
- Considered optional or alternative treatments

Level of Evidence:
- Generally lower or intermediate levels of evidence
- Generally, but not consistently, positive results

Class III:
- Unacceptable
- Not useful clinically
- May be harmful

Level of Evidence:
- No positive high-level data
- Some studies suggest or confirm harm

Indeterminate
- Continuing area of research
- No recommendations until further research

Level of Evidence:
- Evidence not available
- Higher studies in progress
- Results inconsistent, contradictory
- Results not compelling

Adapted from: The Emergency Cardiovascular Care Committees of the American Heart Association and representatives from the resuscitation councils of ILCOR: How to Develop Evidence-Based Guidelines for Emergency Cardiac Care: Quality of Evidence and Classes of Recommendations; also: Anonymous. Guidelines for cardiopulmonary resuscitation and emergency cardiac care. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Part IX. Ensuring effectiveness of community-wide emergency cardiac care. *JAMA* 1992;268(16):2289-2295.

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This CME enduring material is sponsored by Carolinas HealthCare System and has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education. Credit may be obtained by reading each issue and completing the post-tests administered in December and June.

Target Audience: This enduring material is designed for emergency medicine physicians.

Needs Assessment: The need for this educational activity was determined by a survey of medical staff, including the editorial board of this publication; review of morbidity and mortality data from the CDC, AHA, NCHS, and ACEP; and evaluation of prior activities for emergency physicians.

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