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Polypharmacy in the Elderly: Clinical Challenges in Emergency Practice

Part I: Overview, Etiology, and Drug Interactions

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Never before has the topic of medical errors been so focused in the public eye as since the release of the National Institute of Medicine's Report, To Err Is Human.[1] *Documenting the consequences of drug-related adverse patient events, this report estimates that 44,000–98,000 hospitalized patients die each year in the United States from medical "mistakes"—i.e., medication errors and inappropriate and/or suboptimal drug prescribing. In fact, medical errors are the eighth leading cause of death in the United States, with more people dying from these events than from highway accidents, breast cancer, or AIDS.[1] Although the true incidence of medical errors has become a subject of heated debate for the medical community, no one can argue with the fact that the problem exists and that it represents a serious and growing public health concern.[2-6]*

What makes this problem particularly frustrating is that most drug-related problems are preventable. Elderly patients are most at risk for drug-related problems since they account for the highest incidence of adverse drug events (ADEs) and deaths.[2,7,8] The emergency department (ED) is hardly immune. Studies suggest that practice in this clinical environment is a significant risk for adverse drug-related events, with preventable medical errors ranging from 52-70%.[8,9] In the emergency setting, rapid clinical decisions must be made in the treatment of elderly patients who often have multiple illnesses and take many medications. With these clinical issues in focus, this article will discuss the scope and causes of polypharmacy in the United States, why the elderly are at high risk, specific drug interactions, and some potential solutions to the problem. Part II of this article will cover high risk drugs, diagnosis of adverse drug effects, legal considerations, and the role of the emergency physician in preventing adverse drug effects.

—The Editor

Introduction

The acutely ill elderly patient provides one of the most challenging patient encounters in the emergency setting. Multiple health-related variables must be considered when providing their medical care.[10] The elderly constitute a heterogeneous group of patients. They possess varying degrees of physiological decline and disease process, which are not always parallel with their age. With aging, the prevalence of chronic diseases, including arthritis, high blood pressure, depression, heart disease, and diabetes, increases. Frequently, two or more diseases will coexist, necessitating the use

of multiple medications. Normal physiologic changes of advancing age, such as decline in organ function and alteration in receptor response, often cause the elderly to manifest disease atypically and to have increased sensitivity to drug effects. In addition, these physiologic changes impact the patient's ability physically to handle drugs, which may lead to toxic accumulations for some drugs despite utilization of therapeutic dosages. Psychosocial factors such as physical disabilities, nutritional status, and financial well-being all must be considered prior to therapeutic recommendations. These and other factors contribute to the clinical difficulty in managing the older patient in the emergency setting.

Polypharmacy is a particularly vexing problem for the emergency clinician. All too often, the elderly patient presents to the ED and hands the clinician a bag filled with multiple medications. This has become so common a phenomenon that it has been termed the "brown bag syndrome."[11] The practitioner must sort through and decipher this bag of often unlabeled and intermingled medications. The emergency physician must determine whether any of these drugs are causing effects that are contributing to the acute presenting problem. Before prescribing any new medications, the clinician must consider each of the patient's current medications to minimize potential drug and food interactions.

Scope of the Problem

Emergency physicians are caring for increasing numbers of older patients every day. There are currently more than 34 million Americans age 65 and older in the United States, accounting for 12.5% of the U.S. population. More than 4 million Americans are older than age 85.[12] The elderly constitute the fastest growing segment of our society. It is projected that by the year 2010, 20% of the U.S. population will be age 65 or older.[13] Between 1992 and 1999, the number of ED visits for the elderly substantially increased. The overall population-based visit rates increased by 18% for people ages 45-64, and by 17% for those ages 65 and older.[14]

Modern medical advances have played a paramount role in ensuring increased life expectancies and better quality of life despite age-related decline in physiologic function or chronic illness. New pharmaceutical products account for a majority of these medical advances in the treatment of the elderly. During the past decade, explosive growth in drug development and expeditious Food and Drug Administration (FDA) approval have led to the introduction of an enormous number of prescription drugs in the United States. An average of 340 new products are approved and added to the formulary each year. Emergency physicians are seeing increasing numbers of elderly patients with multiple diseases and complex pharmaceutical regimens.

Polypharmacy is predominantly a problem of the elderly. In 1998, nearly 2.5 billion prescription medications were dispensed by U.S. pharmacies at a cost of $92 billion.[1] A large proportion of these prescription medications was dispensed to individuals ages 65 and older. In addition, adults older than age 65 buy 30% of all prescription drugs and 40% of all over-the-counter drugs. The elderly also have experienced a 116% increase in their prescription drug spending from 1992 to 2000. For the year 2000 alone, it is estimated that elderly individuals spent an average of $1205 on prescription medications.[15] Further, 90% of people older than age 65 take one or more prescription medications on a daily basis, with most taking two or more medications per day.[16] In one study, nursing home residents were shown to use an average of six different medications daily, with more than 20% using 10 or more different drugs per day.[17]

The annual national cost for medical care resulting from drug-related morbidity and mortality has been estimated as high as $76.6 billion.[18] Studies reveal that 3–28% of hospital admissions are due to ADEs, and 3–4% of all hospitalized patients experience injuries from adverse events that lead to prolonged hospitalization or disability.[1,9,19] The elderly are at highest risk for experiencing an adverse event.[9,19,20] In a landmark study of more than 30,000 hospi-

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Table 1. Factors that Contribute to Adverse Drug Effects in the Elderly

- Polypharmacy
- Multiple physicians and treatment locales
- Use of over-the-counter medications and herbal products
- Physiologic changes of aging
- Chronic medical illness
- Physical limitations (dementia/hearing impairment/poor vision)
- Look-alike medications
- Sound-alike medication names

talized patients, patients older than age 64 experienced adverse events at a rate that was more than double the rate for patients age 45 and younger.[8,19] Drug complications were found to be the most common single type of adverse event and often were judged to be preventable.[7,8,17,21,22] The elderly are at the highest risk for suffering a fatal adverse drug reaction. Mortality data for the year 1995 from the National Center for Health Statistics and the FDA surveillance system reveal that patients older than age 60 accounted for the majority of deaths attributable to adverse drug reactions.[2]

The true overall incidence of ADEs occurring in the United States is unknown. Currently, there is no national mandatory reporting system in existence, and voluntary reporting systems are notoriously poor.[20,23,24] Hospitalized patients, for whom the most epidemiology is available, only represent a fraction of the entire patient population at risk for experiencing drug-related problems. Few studies of drug-related complications are available for the ambulatory care setting, and even fewer data exist for the emergency care setting.[25-27] With more than 100 million ED visits per year in the United States, it would be expected that a significant number of patients present for care for drug-related problems or experience ADEs resulting from their emergency care. The incidence of clinically relevant drug interactions from ED-initiated medications was found to range from 3.1% to 10%.[28,29]

Etiology of Polypharmacy

There are several factors that account for the high prevalence of drug use in the elderly. Elderly individuals tend to suffer from both chronic medical illnesses and age-related decline in organ function. Often, multi-drug therapy is required for elderly individuals to maintain their health. Elderly patients frequently have several health care providers, each of whom prescribes different medicines, leading to large, complex medication regimens.

Self-medication is a significant contributor to polypharmacy. There is a plethora of over-the-counter products available, many containing ingredients capable of producing adverse reactions and dangerous drug interactions.[30-32] In recent years, several formulations of prescription drugs have become over-the-counter medications. Some of these medications, such as cimetidine, nonsteroidal anti-inflammatory drugs (NSAIDs), and antihistamines, are known to cause serious side effects and drug interactions. Alternative medical therapies have become increasingly popular, as well.[33] In the past five years, herbal medicinal sales have skyrocketed.[34] However, numerous herbal medicinal and homeopathic preparations have the potential to cause toxicity and serious drug interactions.[35] Herbal products are not tested rigorously due to their classification as food supplements, and lack of standardized dosages and the potential for adulteration are of concern when using these products. The elderly frequently self-medicate with both over-the-counter medications and herbal preparations.[36] They often do not consider these products to be "medications," nor do they consider the potential for adverse effects. Clinicians should ask all patients about their use of these products, because the majority of patients omit over-the-counter medications and herbal preparations from their medication histories.[33,36]

Physicians contribute to the problem of polypharmacy by over-prescribing to patients. Drug manufacturers spend billions of dollars on drug promotion efforts that target both physicians and elderly patients alike. In recent years, an increasing trend has been observed of drug companies advertising directly to consumers through television commercials and other popular media. This practice may result in patients placing pressure on practitioners to prescribe specific drug products. Nowhere is this problem of over-prescribing more apparent than in the emergency setting. A significant number of visits to the ED result in the addition of a new medication. Studies have found that a visit to the ED resulted in a new drug prescription for 47-61% of patients.[13,28] Emergency providers often feel compelled to prescribe a new medication to meet a perceived patient expectation, or to provide symptomatic relief for ailments that have no cure. Unfortunately, given the fast pace of the ED, it often is more expeditious to pull out a prescription pad than to spend time educating a patient.

Vulnerability of the Elderly

Polypharmacy is an important risk factor for ADEs. *(See Table 1 for factors that contribute to ADEs.)* The number of medications a patient takes is directly related to his risk of experiencing ADEs.[7,20,28,29,37] Patients taking two medications are at 13% risk for a drug interaction. A dramatic increase in risk is seen when more than three medications are used simultaneously. The risk increases to 58% for five medications and 82% for seven or more medications.[37]

Multiple drug regimens are challenging to manage for any patient. Mistakes such as forgetting to take a medication dose, taking an extra medication dose, or mistaking the identity of a medication are common. Elderly patients frequently have physical limitations, such as poor eyesight, loss of hearing, or memory loss, that may contribute to medication dosing errors. Errors frequently occur in filling weekly drug chambers, particularly when the patient takes pills that are similar in appearance or name. Storing medications outside their original prescription bottles is a common and dangerous practice. Often the patient forgets the identity of the individual pills, greatly complicating the efforts of caregivers and health care providers. Drug manufacturers contribute to the problem of medication errors by marketing drugs with similar trade names or appearances.[38] *(See Tables 2 and 3 for important examples of drugs with similar names and appearances.)* This became very evident with the three drugs Celebrex (celecoxib), Celexa (citalopram hydrochloride), and Cerebyx (fosphenytoin). By 1999,

Table 2. Examples of Drugs with Similar Names

• Adderall	—	Inderal		
• Accutane	—	Accupril	—	Aciphex
• Albuterol	—	Atenolol		
• Celexa	—	Celebrex	—	Cerebyx
• Clinoril	—	Clozaril		
• Dilaudid	—	Dolobid		
• Flomax	—	Fosamax		
• Klonopin	—	Clonidine		
• Stadol	—	Haldol		
• Zantac	—	Xanax		
• Zyprexa	—	Zyrtec		

Table 3. Examples of Drugs with Similar Appearance

• Cordarone	–	Bethanechol 10 mg			
• Dalmane	–	Prozac			
• Famvir	–	Augmentin 500 mg			
• Norpace 100 mg	–	Dyazide			
• Prevacid	–	Sporanox			
• Tylox	–	Feldene 20 mg	–	Rifamate	– Mycobutin
• Valium	–	Haldol			
• Zileuton	–	Ibuprofen			
• Diuril	–	Cortone			
• Rhythmol	–	Toprol XL 100	–	Vicoprofen	

the FDA reported more than 50 mix-ups involving these drugs.[39] With the recent passage of the "Fast Track" law that allows for rapid approval of a new drug if the manufacturer asserts a "desperate need," there is reduced time allotted to scrutinize clinical trials and to review drug naming, packaging, and labeling.[40,41] Examples of "Fast Track" drugs that subsequently have been sanctioned are Lotronex, Posicor, Propulcid, and Raplon.

Elderly patients often have multiple chronic illnesses that predispose them to drug-related complications. Patients age 65 and older have an average of five coexisting medical conditions.[42] Exacerbation of a preexisting medical illness or development of a new illness can affect dramatically the way a drug is handled in the body. For instance, a patient who suffers from mild renal insufficiency and develops gastroenteritis and dehydration may become suddenly lithium-toxic from his usual dose of this medication. Lithium, a cationic substance, is eliminated almost entirely by the kidneys, where it is handled like sodium. Any state that causes dehydration or excessive sodium reabsorption will cause lithium retention and possibly intoxication.

Physiology

With advancing age, everyone experiences some degree of physiologic decline that is characterized by a progressive decline in organ function and loss of the ability to preserve homeostasis. The degree and speed of decline varies from person to person and from organ system to organ system.[43] Both pharmacokinetics and pharmacodynamics are affected by these physiologic changes. Pharmacokinetics describes the processes of drug absorption, distribution, metabolism, and clearance. Pharmacodynamics refers to how the body responds to medications. It is important for the clinician to recognize that significant declines in organ function occur even in elderly individuals who appear healthy, predisposing them to potential drug toxicity. This subclinical decline in organ function may become apparent only during times of physiologic challenge, such as that imposed by acute illness or new drug therapy. For example, a patient with marginal but compensated cardiac function may develop congestive heart failure shortly after beginning a newly prescribed nonselective beta-blocker agent.

Body Composition. Drug distribution is altered greatly in the elderly patient due to changes in body composition. With advancing age there is a significant loss of lean body mass in proportion to the gain of adipose tissue.[43] There is also an age-related loss in total body water of up to 10-15%.[44,45] Highly lipid-soluble drugs, such as diazepam, lidocaine, and phenytoin, tend to have a larger volume of distribution in older persons. This can result in a prolonged elimination half-life and increased risk for toxicity for these drugs. Conversely, water-soluble drugs, such as digoxin, theophylline, and various antibiotics, will have a reduced volume of distribution, resulting in peak effects that develop more rapidly and are more pronounced than would be anticipated. These medications should be reduced to the lowest recommended doses to avoid potential toxicity.

Age-related decreases in serum protein greatly affect drugs that are highly protein-bound, such as sulfonyureas and phenytoin. A decline in protein synthesis due to malnutrition or aging will result in fewer protein carriers and a larger fraction of unbound drug. The unbound portion of drug is the active fraction because an unbound drug can distribute freely across membranes and cause therapeutic effects. Caution must be exercised when interpreting serum drug levels, which typically reflect the total amount of free and unbound drug in the bloodstream. With diminished protein stores, the proportion of free drug can increase substantially and toxicity can occur at even therapeutic drug levels.[46]

Cardiovascular Function. Cardiac output decreases at a rate of 1% per year after age 30. As ventricular contractility declines, the heart increasingly depends on endogenous catecholamines for ionotropic support of the heart. With advanced age, the decline in cardiac output becomes clinically significant and results in decreased perfusion to vital organs. Sinus node dysfunction and conduction abnormalities also are more common in the elderly. Care must be taken in the administration of beta-blockers or calcium channel blockers because they may precipitate congestive heart failure and/or varying degrees of heart block in susceptible individuals.[44]

Maintenance of blood pressure with positional changes depends on the coordinated events of the autonomic nervous system. Upon standing, reflex sympathetic discharge and parasympathetic inhibition increase peripheral vascular tone, heart rate, and contractility to maintain blood pressure. Elderly patients have a decreased responsiveness to the autonomic nervous system, which predisposes them to develop orthostatic hypotension. This can be exacerbated by use

Table 4. Common Drugs that Are Inhibitors and Inducers of the P450 Enzymes

P450 ENZYME INHIBITORS	
• Allopurinol	• Fluoxetine
• Amiodarone	• Itraconazole
• Cimetidine	• Ketoconazole
• Ciprofloxacin	• Metronidazole
• Clarithromycin	• Omeprazole
• Diltiazem	• Paroxetine
• Disulfiram	• Propoxyphene
• Erythromycin	• Quinidine
• Fluconazole	• Sulfonamides
• Indinavir	• Verapamil
• Isoniazid	

P450 ENZYME INDUCERS
• Barbiturates
• Carbamazepine
• Chronic ethanol use
• Griseofulvin
• Phenytoin
• Rifampin

of antihypertensives, tricyclic antidepressants, and phenothiazines.[46]

Renal Function. The most consistent pharmacokinetic change that occurs with aging is a decrease in renal function. With aging, a significant loss of renal mass occurs, resulting in a decreased number and size of glomeruli. Renal blood flow is reduced significantly and the glomerular filtration rate (GFR) decreases by 50% between the ages of 30 and 80.[46] The decline in cardiac output that also occurs with advancing age contributes to decreased perfusion to the kidneys. Renal perfusion increasingly becomes more dependent on elevated renin-angiotensin levels. For this reason, care must be taken when prescribing angiotensin converting enzyme (ACE) inhibitors to the elderly, as they have been known to precipitate renal insufficiency.[47] Patients with hypertensive renovascular disease especially are prone to acute deterioration in renal function from ACE inhibitors and nonsteroidal analgesic agents, due to their dependence on renal afferent arteriolar vasodilatation to maintain glomerular blood flow.[48] Unfortunately, serum creatinine is not a reliable indicator of renal decline. Serum creatinine may be normal even in the face of a significant renal impairment. Several age-adjusted formulas and nomograms exist to aid clinicians in estimating creatinine clearance. However, as age-related declines in GFR are not universal, the clinician must be careful when using these formulas, which can overestimate creatinine clearance by as much as 20%.[46] Use caution when prescribing drugs with narrow therapeutic ranges such as digoxin, aminoglycoside, lithium, and procainamide. This would be particularly true for the chronically ill patient, who can be assumed to have a decline in renal function. Precautionary measures, such as starting the patient on the lowest therapeutic dose and frequent initial monitoring of their serum drug levels and renal function, should be performed when prescribing these medications.

Gastrointestinal Function. The effects of aging on the gastrointestinal system include decreases in gastric acid production, motility, and active membrane transport. Despite these changes, the bioavailability of most drugs is not reduced significantly. Certain drugs, such as ketoconazole, digoxin, quinolones, tetracycline, phenytoin, and cimetidine, depend on an acid environment for absorption and may have a decreased bioavailability secondary to the age-related increase in gastric pH.[48] The co-administration of antacids, proton pump inhibitors, and H2-blockers should be avoided with these drugs.

With aging there is a decline in mucosal function that normally protects the stomach from drugs associated with ulcer formation. This involves a decrease in production of mucosal prostaglandins as well as a decline in mucosal blood flow, gastric mucous, and bicarbonate secretion. These factors, in combination with delayed gastric emptying, increase the risk of gastrointestinal bleeding from NSAIDs and aspirin.[48] Short-term use of NSAIDs at the lowest recommended dose should help avoid these complications. Some studies have shown that concomitant use of a proton pump inhibitor appears to be effective in preventing gastroduodenal ulcers in patients with previous history of ulcer. Proton pump inhibitors were found to be superior to H2-receptor blockers.[49] The cyclooxygenase-2 inhibitors have been shown to have a reduced capacity to cause gastroduodenal injury.[49-51]

Hepatic Function. The general purpose of metabolism is to produce a water-soluble metabolite that can be excreted easily into the bile or urine. In contrast to renal metabolism, hepatic drug metabolism varies widely among patients, and there are no predictable age-related alterations. The efficiency of hepatic metabolism is influenced by blood flow, functional hepatocyte number, and activity of the cytochrome P450 mixed-function oxidase system.[44] Hepatic mass, the number of functional hepatocytes, and the activity of the cytochrome P450 system decline with age. Hepatic blood flow declines by 40-50% with advancing age.[43] Drugs that undergo rapid first-pass hepatic metabolism, including lidocaine, verapamil, propranolol, and nitrates, are most affected by age-related declines in hepatic blood flow.[46]

The metabolism of most drugs relies more upon enzyme activity than hepatic blood flow. There is a significant decrease in hepatic oxidative enzyme activity with advancing age. This results in a prolonged half-life and greater drug accumulation for many pharmaceuticals. This is seen particularly with some benzodiazepines such as diazepam and flurazepam.[46] These two drugs have a prolonged duration of action and cause excess central nervous system (CNS) depression in the elderly. This is secondary to their large volume of distribution, decreased hepatic clearance rate, and the ongoing pharmacological effects of their active metabolites. The use of long-acting benzodiazepines in the elderly can produce devastating clinical consequences. Their use has been associated with excess sedation and an increased incidence of falls and hip fractures.[52-55] When benzodiazepines are indicated for an elderly patient, safer choices include midazolam, oxazepam, lorazepam, and triazolam.

Pharmacodynamics

Elderly individuals commonly have a varied response to drugs. With aging, alterations in end-organ responsiveness occur that cause exaggerated or diminished therapeutic effects. Pharmacody-

namic changes most likely occur at the receptor level and consist of changes in receptor number, binding kinetics, or biochemical reactions. The central nervous and cardiovascular systems are particularly vulnerable to changes in pharmacodynamics. Alterations in drug responsiveness in these systems are of the utmost clinical importance in the elderly. Slowing in cognition and memory function and diminished CNS dopaminergic activity are seen consistently with aging.[52] Increased sensitivity occurs for many CNS depressant drugs, especially narcotic analgesics. For example, it has been shown that elderly individuals undergoing anesthesia require half the dose of fentanyl to induce the same degree of drug effect as seen in younger patients.[52] Physiologic changes of aging that occur in the cardiovascular system include decreases in heart rate, cardiac output, coronary blood flow, and blood vessel elasticity. The clinical consequences of these changes are significant, such as decreased chronotropic response to beta-blockers and increased antihypertensive affect to calcium channel blockers, which can lead to dangerous, precipitous drops in blood pressure, such as seen with sublingual nifedipine.[56]

Drug Interactions

Many serious ADEs are due to drug interactions.[57-59] Prescribing new medications in the emergency setting is particularly perilous. Patient encounters are brief and frequently result in pharmacologic interventions despite incomplete medication and illness histories. The risk of drug interaction has been shown to increase dramatically when three or more medications are administered simultaneously.[37] In addition, up to 30% of patients presenting to the ED are already at risk for a potential drug interactions from their current medications.[29]

Drug interactions can occur through several different mechanisms. Pharmacokinetic interactions occur when one drug alters a second drug's absorption, distribution, metabolism, or excretion. Alterations in drug metabolism most likely account for the majority of clinically significant and life-threatening drug interactions. Pharmacodynamic interactions occur when one drug potentiates or inhibits the effect of a second drug. Pharmacodynamic interactions are mediated through either direct or indirect receptor effects. For example, a patient taking a beta-2-adrenergic agent for asthma may experience reduced bronchodilation effects when also given a nonselective beta-blocker drug. Another example is the synergism that occurs between drugs with anticholinergic properties. Common drugs that possess anticholinergic activity include tricyclic antidepressants, antipsychotics, antihistamines (i.e., diphenhydramine), muscle relaxants, and scopolamine. Combining these medications can lead to anticholinergic toxicity (i.e., dry mouth; flushed, hot skin; confusion; dilated pupils; and urinary retention).

The bulk of drug metabolism occurs in the liver through the cytochrome P450 (CYP) microsomal enzyme system. The CYP3A4 enzyme is responsible for the majority of drug metabolism. A newly added drug that causes inhibition of the P450 enzyme system may cause decreased hepatic clearance of preexisting drugs that also are dependent on the P450 enzyme system for their metabolism. As result, these drugs will have increased plasma concentrations and prolonged half-lives that may lead to toxic effects. Clinicians should pay special attention to drugs that have a narrow range of therapeutic index. Serious drug interactions can occur, leading to life-threatening drug toxicity. A good example is theophylline, which has therapeutic effect at serum concentrations of 10-20 mcg/mL but typically causes toxic effects once drug levels rise above 20 mcg/mL. When erythromycin is taken concurrently with theophylline, serum theophylline levels rise an average of 30-35%.[60] Drugs that cause induction of the P450 enzyme system may cause increased hepatic clearance and subtherapeutic concentrations of preexisting drugs. Dosage adjustments must be made to ensure therapeutic effect. *(See Table 4 for common drugs that are P450 enzyme inducers or inhibitors.)*

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Physician CME Questions

83. A study of more than 30,000 hospitalized patients found that, among patients older than age 64, the rate of adverse drug events was:
    A. the same as that of patients ages 45 and younger.
    B. more than triple the rate for patients ages 45 and younger.
    C. more than double the rate for patients ages 45 and younger.
    D. half the rate for patients ages 45 and younger.

84. What is the average number of medications taken by nursing home residents?
    A. Three
    B. Four
    C. Five
    D. Six
    E. Seven

85. All the following medications inhibit P450 enzymes *except*:
    A. verapamil.
    B. clarithromycin.
    C. phenytoin.
    D. ciprofloxacin.

86. The age-related physiologic changes that account for drug toxicity include:
    A. decreased cardiac output.
    B. decreased gastric acid production.
    C. decreased serum protein.
    D. loss of functional hepatocytes.
    E. All of the above

87. On average, how many coexisting medical conditions do patients age 65 and older have?
    A. Two
    B. Three
    C. Four
    D. Five

88. Which of the following factors contribute(s) to adverse drug effects in the elderly?
    A. Physiologic changes of aging
    B. Chronic illness
    C. Use of over-the-counter and herbal products
    D. Multiple physicians and treatment locales
    E. All of the above

89. Which age-related changes in body composition in the elderly can greatly alter drug distribution in the body?
    A. Loss of lean body mass in proportion to the gain of adipose tissue
    B. A decrease in total body water
    C. An increase in the level of serum protein
    D. Both A and B

90. Which of the following increase(s) the risk of gastrointestinal bleeding from NSAIDs and aspirin?
    A. A decline in mucosal blood flow in the stomach
    B. Delayed gastric emptying
    C. Decreased production of mucosal prostaglandins
    D. All of the above

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With this issue of *Emergency Medicine Reports*, EMRonline will post a link to more information on treating elderly patients in the emergency department. Visit www.EMRonline.com for the full text of the recent *Geriatric Emergency Medicine Reports* article "Abdominal Pain in the Elderly Patient." Log on now.

In Future Issues: **Polypharmacy in the Elderly, Part II**

Emergency Medicine Reports CME Objectives

To help physicians:

- quickly recognize or increase index of suspicion for specific conditions;
- understand the epidemiology, etiology, pathophysiology, and clinical features of the entity discussed;
- be educated about how to correctly perform necessary diagnostic tests;
- take a meaningful patient history that will reveal the most important details about the particular medical problem discussed;
- apply state-of-the-art therapeutic techniques (including the implications of pharmaceutical therapy discussed) to patients with the particular medical problems discussed;
- understand the differential diagnosis of the entity discussed;
- understand both likely and rare complications that may occur;
- and provide patients with any necessary discharge instructions.

Emergency Medicine Reports
The Practical Journal for Emergency Physicians

Polypharmacy in the Elderly, Part I

Factors that Contribute to Adverse Drug Reactions in the Elderly

- Polypharmacy
- Multiple physicians and treatment locales
- Use of over-the-counter medications and herbal products
- Physiologic changes of aging
- Chronic medical illness
- Physical limitations (dementia/hearing impairment/poor vision)
- Look-alike medications
- Sound-alike medication names

Examples of Drugs with Similar Appearance

- Cordarone – Bethanechol 10 mg
- Dalmane – Prozac
- Famvir – Augmentin 500 mg
- Norpace 100 mg – Dyazide
- Prevacid – Sporanox
- Tylox – Feldene 20 mg – Rifamate – Mycobutin
- Valium – Haldol
- Zileuton – Ibuprofen
- Diuril – Cortone
- Rhythmol – Toprol XL 100 – Vicoprofen

Examples of Drugs with Similar Names

- Adderall — Inderal
- Accutane — Accupril — Aciphex
- Albuterol — Atenolol
- Celexa — Celebrex — Cerebyx
- Clinoril — Clozaril
- Dilaudid — Dolobid
- Flomax — Fosamax
- Klonopin — Clonidine
- Stadol — Haldol
- Zantac — Xanax
- Zyprexa — Zyrtec

Common Drugs that Are Inducers and Inhibitors of the P450 Enzymes

P450 ENZYME INHIBITORS

- Allopurinol
- Amiodarone
- Cimetidine
- Ciprofloxin
- Clarithromycin
- Diltiazem
- Disulfiram
- Erythromycin
- Fluconazole
- Indinavir
- Isoniazid
- Fluoxetine
- Itraconazole
- Ketoconazole
- Metronidazole
- Omeprazole
- Paroxetine
- Propoxyphene
- Quinidine
- Sulfonamides
- Verapamil

P450 ENZYME INDUCERS

- Barbiturates
- Carbamazepine
- Chronic ethanol use
- Griseofulvin
- Phenytoin
- Rifampin

Supplement to Emergency Medicine Reports, May 20, 2002: "Polypharmacy in the Elderly: Clinical Challenges in Emergency Practice—Part I: Overview, Etiology, and Drug Interactions." *Authors*: **Katherine M. Prybys, DO, ACTM,** Assistant Professor of Emergency Medicine, University of Maryland Medical System, Baltimore; **Kraig A. Melville, MD, FACEP, FAAEM**, Chief, Emergency Medical Services, Calvert Memorial Hospital, Prince Frederick, MD; **Jeahan R. Hanna, MD**, Chief Resident, Emergency Medicine, University of Maryland Medical System, Baltimore.

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Emergency Medicine Specialty Reports

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By its very nature, the emergency department (ED) is the hospital's melting pot for potential medical malpractice cases. The emergency physician (EP) must evaluate and deal with a great number of patients in an efficient manner, remain vigilant for life-threatening illness, and make critical patient care decisions based on limited information.

Estimates of the cost of medical malpractice to the health care community, whether it is spent defending cases, ordering extra tests, or admitting patients who otherwise could be treated as outpatients, lie between $50 billion and $180 billion per year, making it the most rapidly escalating cost associated with health care. The EP must attempt to identify relevant risks, eliminate those that are correctable, and minimize those that cannot be eliminated.

— The Editor

Medical Malpractice and High-Risk Patients in the Emergency Department

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The attractions of emergency medicine (EM) are as diverse as the physicians who choose it for a specialty. The varied patient population, the broad range of pathology, and the diversity of skills the EP possesses differentiate EM from other practice areas. Unfortunately, the relatively high rate of legal claims against EPs also distinguishes them from other specialists.[1-3] The ED demands prompt, time-critical decision-making, often based on limited patient information. Additionally, the ED can be a frenetic place, with the multi-tasked EP treating several ill patients at once. These stresses in the practice of EM make for an environment ripe with potential for litigation. EPs must educate themselves not only about areas of law pertaining to EM, but also about specific high-risk situations that may lead to future litigation.

The scope of the problem can be seen in both the type of claims against EPs and the relative dollar amounts paid out on average for each claim. Presenting complaints common to the ED also commonly are associated with claims of negligence against EPs. For example, chest pain accounts for approximately 10% of all patients presenting to the ED, and not coincidently, accounts for a similar number of claims against EPs.[4] What is significant is the disproportionate amount of money paid to settle claims involving presentations of chest pain. Why are certain patient presentations at risk for litigation and potentially high settlements? To understand and recognize these high-risk patients, the EP must possess a basic knowledge of the legal system as it pertains to medical malpractice, along with insight into how best to handle high-risk presentations.

This article reviews the basic elements of laws most likely to affect practitioners. Particular attention is given to medical negligence, as it is of particular concern to many EPs because of the relative frequency with which claims arise and the potential for adverse financial impact.

The second part of the article focuses on selected high-risk patient presentations and scenarios common to the ED. Historically, certain patient characteristics have indicated a higher risk for medical malpractice claims. Profiles of these patient presentations will be described, along with tools the EP can utilize to decrease the chance of potential litigation.

Legal Basics

No attempt is made here to fully explain the intricacies of the legal system, but a few basics should be mentioned. The American legal system has two basic sources of law: case law and statutory law. Judges "write" case law when deciding cases before them, and subsequent judgments are expected to follow these same case laws. Legislative bodies on the federal, state, and local levels promulgate statutory law. Both case law and statutory law are germane to any discussion of medicolegal issues.

The concept of case law has its origin in medieval England. At that time, a system of royal courts was established to settle disputes among citizens. Novelties in this fresh system included a right to trial

for the accused and the right to be judged by a jury of citizens. The system was supported by the two strongest institutions of the day—the church and the monarchy. With this support, the system of royal courts flourished.

As the number of cases heard by the new courts grew, so did the number of rulings and decisions handed down by the courts. This collective group of rulings began to be known as the "common law," and subsequent courts were expected to follow these rulings under the theory of *stare decisis* (literally, "following the precedent"). This concept of following legal precedent from other rulings was brought to the American colonies by English settlers and is the basis for modern-day common law.

Case law is the source of many legal principles that affect the EP. The elements of legal concepts such as negligence are found not in state codes, but must be culled from previous case reports. Lawyers, judges, and other officers of the court will look to prior rulings for guidance on legal points and frequently will cite specific previous cases to shore up an argument or explain a decision. Law students learn the law in much the same way; copious amounts of the law student's time is spent reading case reports in an effort to learn the basic elements of the law and how those elements apply in different situations.

Statutory law is proposed, written, and approved by the legislative branches of various levels of government. Statutory law can range from national initiatives (such as the Emergency Medical Treatment and Active Labor Act [EMTALA], passed by Congress in 1986) to state laws (such as the establishment of a maximum blood alcohol concentration for vehicle operators) to local ordinances (such as city zoning requirements).

The distinctions between these two basic areas of the law are not as clear as the two paragraphs above might suggest. Common law written by judges can be superceded by legislative action, and laws codified by legislative bodies are subject to review and interpretation by the courts. This system of checks and balances by separate branches of our government is the essence of our democracy, but can lead to confusion. The EMTALA law, for example, was enacted by Congress, but has undergone numerous reinterpretations by courts, leading to expansion of the original law. Common law, similarly, is a fluid body of law subject to both legislative review and reinterpretation by the courts as social priorities and technology evolve.

The astute EP will have a basic understanding of both the common law issues (such as the elements of negligence) and the statutory laws (such as tort reform) that apply to the delivery of medical care to high-risk patients. Certainly, there are other legal subjects (e.g., EMTALA, contract negotiations, etc.) that should be known to every EP, but those issues are beyond the scope of this paper.

Medical Malpractice—The Common Law

The theory of medical malpractice is a subset of an area of law known as torts. The word "tort" is from the Latin *tortus,* meaning "twisted" or "crooked," and is used in modern legal terms to indicate an action where one party has unlawfully wronged another. The body of law known as torts, which includes assault, battery, and negligence, mainly is derived from case law. Within the tort known as negligence is the subset of professional negligence, and within that category lies medical malpractice, a type of professional negligence.

Medical malpractice (by negligence) assumes that a medical professional has breached a duty to act in a reasonable manner and that such breach has caused foreseeable damage to an individual.[5] To successfully pursue a claim for medical malpractice against a physician, an allegedly damaged party must prove the four elements of negligence: duty, breach, causation, and damages. Each of these elements will be addressed individually.

Duty. The first element of an action against a physician for negligence is the establishment of a duty owed by the physician to a patient. It generally has been held that a duty is owed once a relationship is established between the physician and patient. The requirements for this relationship to be established depend on the practice area of the treating physician; for EPs, it is established when the patient enters the door of the ED.

Once a relationship has been established between a physician and patient, the physician has a duty to provide a certain standard of care (SOC) to the patient. The SOC is the care and skill that would be provided by a prudent physician in the same specialty under similar circumstances. It is not enough that a physician practices at the top of his or her ability or without carelessness; ultimately, the care rendered must meet a minimum SOC established within a specialty.

The SOC is determined by testimony at trial. Both the defendant and plaintiff involved in litigation will provide experts who will testi-

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fy what, in their opinion, the SOC is for a particular physician in a particular specialty. The experts will rely on textbooks, journals, national standards, or accreditations (e.g., certification in the American Heart Association Advanced Cardiac Life Support or American College of Surgeon's Advanced Trauma Life Support, etc.) to demonstrate to the court what the SOC should be. Ultimately, the court (either the judge or jury) will decide, based on the testimony of the experts, what SOC to apply.

Breach of Duty. Once it has been established that a physician owed a duty to a patient and a SOC has been established, a plaintiff then must prove that the physician breached the duty owed by not adhering to the established SOC. As a practical matter, the same plaintiff's experts who testify to establish the SOC also will testify that the defendant did not meet the SOC.

It usually is the responsibility of the plaintiff to prove that the defendant breached the duty owed, but there are exceptions. Under the doctrine of *res ipsa loquitur* (literally, "the thing speaks for itself"), the burden of proof can shift from plaintiff to defendant. This doctrine may be invoked in a case in which an adverse outcome is caused by factors within the exclusive control of the defendant and there is no other explanation, short of the defendant's negligence, that could explain the adverse outcome. An example of invocation of the *res ipsa loquitur* doctrine against an EP might be a case where a patient suffers vascular damage from a central line wire inadvertently left in the patient. In such a case, it is conceivable that the burden of proof might shift to the EP to prove he or she was not negligent and adhered to the relevant SOC. A second instance in which *res ipsa loquitor* can be invoked is when a plaintiff cannot identify who committed the negligent act. This doctrine removes from the plaintiff the burden of identifying the negligent party.

Causation. The third element that must be proved by the plaintiff is causation. Causation is the concept that there is a direct link between the failure of the defendant to adhere to the established SOC and injury suffered by the plaintiff. It is not enough that a physician acts negligently; the negligence must be a direct, proximate cause of an injury.

Despite its apparent simplicity, causation frequently is the most difficult area of negligence for juries and the layperson to grasp and, therefore, can be the most difficult element to prove. Frequently, the same experts used to establish the SOC are asked to testify about the causal link between the alleged negligence and resultant injury. Because of the complexity of the causation issue, judges have been given increasing latitude to decide which testimony will or will not be allowed in court to help determine causation.[6]

Damages. If a plaintiff has proved the first three elements of negligence, it then is incumbent upon him or her to show that the negligence of the defendant ultimately caused damage to the plaintiff. Damages frequently are of the economic sort (e.g., lost wages, expenses for further medical care, etc.), but actions also can be maintained for emotional or personal damages. Requirements for proving emotional distress, deterioration of quality of life, and other, not-easily-quantifiable damages are stringent and vary from jurisdiction to jurisdiction.

Occasionally, an award will be made for nominal damages, sometimes as little as $1. Seemingly insignificant, these nominal damages open the door for the plaintiff to ask for punitive damages against a defendant, which can be substantial.

Medical Malpractice—Relevant Statutes

The definition of negligence is found in the common law. There are, however, several laws enacted by the legislature that affect medical malpractice cases. These laws address procedural aspects of medical malpractice, such as time periods when a case can be brought, qualifications of experts, and limits on damages.

Statutes of Limitation. Each state has a set of laws that limit the amount of time a plaintiff has to bring a lawsuit. These laws collectively are known as statutes of limitation (SOL). The premise behind these laws is that misdeeds should be litigated within a reasonable amount of time. The amount of time a plaintiff has to pursue a claim varies from state to state, and may differ depending on the facts of each individual case. Generally, these statutes limit the amount of time to sue to a period of several years. An example of such a statute is the Virginia SOL for medical malpractice claims, which sets the SOL for personal injuries at two years, but specifically extends that same SOL when an injury is not apparent immediately (as in the case of a foreign body inadvertently left in a patient's body), or when the injury is concealed from the patient by means of fraud.[7] In general, failure of a plaintiff to file a cause of action within the statutorily defined period of time to do so allows the defendant physician to petition the court to dismiss the case without any consideration of the facts of the case.

Qualification of Experts. An expert witness may testify as to the relevant SOC that should apply in a case, whether or not, in the expert's opinion: 1) the SOC was met; and 2) if the defendant failed to meet the SOC, if that failure caused the alleged damage to the plaintiff.[8] Courts as powerful as the U.S. Supreme Court have acknowledged that the role of the expert in tort cases is a powerful one, and have said that experts should be given wide latitude to express their opinions.[6]

Under common law, the qualification of experts was cumbersome and lengthy. The expert's education, experience, and other relevant qualifications were presented, and the court decided whether the witness was competent to testify as an expert in a particular case. What followed was a series of hypothetical questions that adhered to strictly regulated standards. Also, under the common law, there was no requirement that an expert be a practitioner of the same medical specialty as the physician he or she was testifying for or against. Courts did acknowledge, however, that the weight the evidence should be given depended on the training and specialization of the expert in a particular area.[9]

In 1975, federal courts, through the Federal Rules of Evidence, attempted to streamline both the qualification of experts and the form in which their testimony could be admitted. Most states subsequently followed the federal government's lead and enacted similar statutes to facilitate expert testimony. An example of such a statute is this one from North Carolina, a rule that nearly is identical to Federal Rule of Evidence 702:

"Testimony by Experts—

(a) If scientific, technical or other specialized knowledge will assist the trier of fact to understand the evidence or to deter-

mine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion.

(b) In a medical malpractice action . . .a person shall not give expert testimony on the appropriate standard of health care . . . unless the person is a licensed health care provider in this State or another state and meets the following criteria:

(1) If the party against whom or on whose behalf the testimony is offered is a specialist, the expert witness must:

a.) Specialize in the same specialty as the party against whom or on whose behalf the testimony is offered; or

b.) Specialize in a similar specialty which includes within its specialty the performance of the procedure that is the subject of the complaint and have prior experience treating similar patients . . . ."[10]

N.C. Rule 702 includes other provisions of expert testimony, including a prohibition against expert testimony on a contingency fee basis; permission for a physician to give expert testimony about other medical personnel, such as nurses and physician assistants; and a requirement that an expert witness be active in clinical practice.

Much of what Rule 702 attempts to achieve falls under the general category of "tort reform." Tort reform is the notion that certain personal injury actions, such as medical malpractice, place the defendant at a distinct disadvantage. Through legislation such as Rule 702's qualification of experts, states have attempted to level the legal playing field between litigants.

Damage Caps. Another attempt at tort reform in some states has been to limit the monetary awards allowed in successful lawsuits. As both the number of lawsuits and the size of judgments against doctors began growing in the latter half of the 20th century, many physicians chose to abandon or limit their practices in an effort to avoid litigation, or because costs secondary to litigation, such as malpractice insurance premiums, became prohibitively expensive.[11]

In an effort to stem the tide of retiring physicians, some states chose to enact statutes that placed a maximum on the pecuniary recovery allowed against health care providers. For example, the limit for recovery against health care providers in Virginia currently is $1.6 million per patient, including both compensatory and punitive damages. The cap applies regardless of the number of defendants named in the suit.[12] Note that, under this statute, the amount of recovery currently is in the midst of a legislatively mandated increase of $50,000 per year until 2008, when the cap for recovery will have increased to $2 million. There are no plans for the limit on recovery to exceed $2 million.

When medical malpractice liability caps first were enacted, there was some debate about the constitutionality of such provisions. Was the limiting of dollars recovered an unconstitutional abridgement of a patient's right to sue and recover for damages? Courts that have addressed this issue have found that limiting plaintiffs' recovery is constitutional and justifies the legislative objective: providing for the health, welfare, and safety of citizens by insuring the continued availability of health care providers in the community.[13]

As with common law, statutes can vary from state to state. Similar statutes may have nuances that alter a physician's rights and responsibilities, depending on the jurisdiction. Questions about specific aspects of medical malpractice law should be directed to an attorney who specializes in tort law in the relevant jurisdiction.

Why Do Emergency Physicians Get Sued?

The process that ends in a lawsuit alleging medical malpractice against an EP usually is complex, with the possible outcome of the case only one of the factors that contributes to the overall decision whether to litigate.[14] While sound medical practice skills are the cornerstone of any physician's armamentarium, other factors, such as behavioral, interpersonal, and communication skills, are mandatory for successful patient interaction and avoidance of litigation. A number of elements come into play during an ED visit. Patients and families frequently present with unrealistic expectations of what can be accomplished. Couple with this anger about long wait times, perceived (or real) inattention from ancillary staff (e.g., registration, nursing, transportation), and lack of creature comforts (e.g., blankets, pillows, an exam room), and the EP has a number of potentially negative factors to contend with when he or she enters the room.

Medical Practice Skills. In terms of medical practice skills, there are a number of areas where the EP can reduce risk. It goes without saying that, in the ED, the clinician should rule out the most serious potential cause of a patient's symptoms based on the patient's age, gender, history, and physical examination. (e.g., chest pain is an acute myocardial infarction [AMI] or pulmonary embolism [PE] until proven otherwise). All "red flags" that are raised must be addressed. These may be in the history, the physical examination, laboratory, or radiographic studies. Abnormal vital signs must be addressed and either explained or corrected. Tests that potentially will result in a change in management should be obtained, while those that would not affect management should not be ordered. Any patient who potentially could have an evolving picture should be reexamined routinely and repeatedly. Finally, all actions need to be meticulously documented in the chart. The goal of documentation is to give a complete picture of the patient's presentation and lead another clinician to the same conclusion that you reached. The perfectly written chart should cover all pertinent historical and focused physical examination findings, pertinent laboratory studies and radiographs, any procedures performed, timed re-examination notes, timed consultation notes with major points of discussion recorded, clearly documented medical decision-making, and the clinical picture and condition at the time of discharge.

A second area for the EP (and the ED as a whole) to focus on is behavioral, interpersonal, and communication skills. Without these, the best care in the world may be rendered, but the patient may leave the ED wholly dissatisfied with the interaction. Introductions not only are courteous, but they let the patient and family know who among the parade of people coming in and out of the room is actually the doctor and in charge. Taking the time to sit down, apologize for wait times, and attend to creature comforts (e.g., blankets, water, and pillows) will be remembered and appreciated by the patient and family. Spelling out the anticipated ED course will give the patient and family an idea of what is to come, and offers a chance to address any concerns and explore any expectations in a prospective manner. Limiting the number of family members who can come back to the patient's room sometimes is necessary, but when possible, any who

want to be with the patient should be allowed. This accomplishes at least two objectives: It gives the EP additional sources of information, and it lets more family members witness "the doctor show," in which they see their loved one being examined and cared for. Again, expectations and agendas can be explored early on in the workup, rather than after the evaluation has been completed, the discharge instructions have been written, and the patient is ready to go.

A final clinical point to focus on concerns discharge instructions. How many times have we seen patients who present to the ED, after having been seen previously at the same or at another facility, and complain that practitioners at their last visit "didn't tell me anything." Clear discharge instructions and follow-up procedures must be provided following any ED visit. The phrase "Follow-up PRN [*pro re nata,* or, 'as necessary']" is a recipe for medicolegal disaster. Instructions should be time-specific and action-specific (e.g., "Return to the ED immediately for any recurrent chest pain," or, "You will be seen in follow-up tomorrow morning at 10:30 a.m. by Dr. X, who is a cardiologist."). Discharge instructions should be written in language appropriate for the patient's level of education, and specifically should address any secondary issues that are of concern to the patient (e.g., return to work, lifting restrictions, timing of medications with food, etc.). If there is any concern about the patient's understanding of discharge instructions, the family members present again should be enlisted to help ensure follow-up and told for which warning signs to watch.

High-Risk Patient Presentations

Chest Pain. A 37-year-old, Hispanic male presented to the ED at 3 a.m. with a chief complaint of inability to sleep secondary to chest burning, nausea, and belching. He reported that the chest burning lasted approximately 30 minutes, was resolved by belching, and has not recurred. Past medical history was significant for elevated cholesterol and tobacco abuse. No family history was recorded. Physical exam of the patient was unremarkable. The attending physician ordered a complete blood count, basic chemistry panel, coagulation studies, a Troponin I test, a chest radiograph, and an electrocardiogram (ECG). The ECG revealed a normal sinus rhythm with nonspecific T-wave changes. Chest x-ray was normal.

One hour after admission to the ED (before any test results have been reported), the patient reported a repeat episode of nausea similar to the one he experienced earlier in the evening. The physician ordered a gastrointestinal cocktail (Donnatal, Viscous Lidocaine, Maalox). The patient reported resolution of his symptoms 15 minutes after the GI cocktail and 30 minutes after the symptoms started. The ECG was not repeated while the patient was symptomatic. Ninety minutes after admission to the ED, the patient's serum test results were returned, and all were within normal limits. He was discharged with instructions to see his primary care physician for follow-up, and to return to the ED if he experienced any chest pain or shortness of breath. The patient returned 12 hours after discharge with altered mental status and hypotension. He subsequently died in the coronary care unit. Autopsy revealed a large myocardial infarction (MI) in the distribution of the right coronary artery.

Discussion. Chest pain is one of the most common complaints seen in the ED, accounting for 4.6 million patient visits per year.[15,16] Coronary artery disease (CAD) is the leading cause of death in the United States, accounting for roughly 20% of all deaths each year.

There are approximately 1.1 million AMIs in this country each year, and it has been estimated that 2-8% of AMIs that present to the ED are missed.[1,4,17,18] Missed AMIs account for 8-11% of claims against EPs annually, but estimates are that up to one-third of dollars paid out are for cases of missed AMI.[3,4,19] The combination of the frequency of chest pain presentation and the risk of potentially large settlements in cases of missed AMI make this an area of particular interest to the EP.

Several authors have attempted to identify specific factors that place a patient at higher risk for a missed AMI, several of which are present in the case above. Patient populations at particular risk for missed AMI include the elderly, the relatively young, women, and ethnic populations.[19-22] Elderly patients are at particularly high risk due to late presentations, a higher incidence of CAD, communication difficulties, and atypical presentations. Unfortunately, this also is the group in which AMIs take a heavy toll; one study showed that even in patients who are hospitalized when diagnosed with AMI, the mortality rate approaches 20% for patients older than 70 years.[23]

Up to 10% of AMIs occur in patients younger than 45 years of age, which presents another diagnostic dilemma for the EP: Is left shoulder pain in the athletic 40-year-old an impingement syndrome or an indication of something more sinister?[23] The key in the assessment for CAD in the young is a thorough review of risk factors. Series of relatively young patients with AMIs reveal that smoking is the most prevalent risk factor in this group, with a positive family history the second most prevalent factor. If concern about premature CAD exists, questioning should go further and include risk factors for atherosclerotic disease (familial dyslipidemias, family history of obesity, or diabetes), as well as risk scenarios for AMI (e.g., cocaine use or anatomic coronary artery abnormalities [congenital, sequelae of childhood disease, and hypercoaguable states]).

Both women and minorities suffer from under-diagnosis, under-treatment, and under-referral for CAD.[20] Additionally, some minorities shoulder the burden of increased prevalence of certain risk factors, such as hypertension and diabetes. These groups warrant special attention from the EP to rule out CAD.

Other factors present in cases of missed AMI in the ED include over-reliance on diagnostic testing. Modern serum markers are extremely sensitive, but may not turn positive for hours after the onset of ischemia. Initial negative serum markers should be supplemented with additional tests at the appropriate time.[24] An initial ECG may be normal in up to 50% of AMIs.[25,26] The ECG is quick and inexpensive, but, like the serum marker, its utility is limited if it is not used serially. The sensitivity of the ECG to AMI is improved if it is used at scheduled intervals or whenever symptoms change.[27]

An atypical presentation can delay or even obscure the diagnosis of AMI. Chest pain is the presenting complaint in 40-75% of patients eventually diagnosed with AMI, which means roughly 500,000 people each year with AMI present with some other complaint such as dyspnea, altered mental status, nausea, or pain in an atypical location such as the abdomen, back, or jaw.[27] Besides being more difficult to diagnose, these patients frequently require longer, more intensive hospital stays once diagnosed.[27]

Abdominal Pain. A 21-year-old male college student presents to the ED at 9 p.m., with a chief complaint of diffuse abdominal pain. The pain started approximately three hours earlier, while he was eating Mexican food. The pain is dull, felt throughout the abdomen, does not radiate, and has not changed in location. The patient came to the ED after taking Maalox, which he thinks made the pain worse.

The review of systems is positive only for one episode of loose stool 24 hours ago. The patient denies any fever, chills, nausea, or vomiting. The patient reports no past medical history, is aware of no allergies to drugs or foods, and his only medication is ibuprofen, which he takes approximately once a month as needed for headache. He denies tobacco or illicit drug use, but does admit to occasional alcohol ingestion; he further reports having had several beers at dinner before the onset of the abdominal pain. He is not sexually active.

A physical exam reveals an anxious-appearing young man with his arm across his abdomen. His heart rate is 110 beats per minute, his blood pressure is 135/85 mmHg, and he is breathing at a rate of 16 breaths per minute. His oral temperature is 37.9°C. The patient is awake and oriented to person, place, and date. His oropharynx is clear, with dry mucous membranes. The neck is supple without lymphadenopathy. The abdominal exam reveals the presence of bowel sounds. The abdomen is soft and without scars. The patient displays discomfort to moderate palpation, especially in the left lower quadrant and midepigastrum, and in fact, patient attempts to push the examiner's hands away from the abdomen during the exam, secondary to pain. No rectal examination is performed. The balance of the physical examination, including pulmonary, cardiovascular, neurological, and musculoskeletal, is unremarkable.

The physician diagnoses gastroenteritis with mild dehydration, and recommends increased fluid intake, abstention from alcohol for the duration of symptoms, and Imodium if the patient's diarrhea returns. The physician also asks the patient to follow up at the college's student health facility on Monday if his symptoms have not resolved completely. No discussion of other possible sources of the pain takes place. The patient is asked to return to the ED if he feels worse. The patient agrees with the plan and is discharged.

The patient returns 20 hours after discharge with nausea, vomiting, fever, and pain that has migrated and now is located solely in the right lower quadrant. He is taken to the operating room and diagnosed with a ruptured appendix.

Discussion. Abdominal pain accounts for approximately 10 % of ED visits.[28,29] It also is a factor in up to 12% of malpractice claims against EPs, and up to 7% of dollars paid out.[4] Like chest pain, abdominal pathology presentation covers a spectrum. The chief complaint of right lower quadrant pain with anorexia and fever combined with rebound on physical examination is not a diagnostic dilemma. The elderly person with a past medical history positive for CAD, peripheral vascular disease, or colon cancer and who presents with the acute onset of nausea and vomiting requires consideration of a wider differential diagnosis.

The diagnosis of appendicitis can be difficult, and the failure to do so may result in significant morbidity or mortality. Unfortunately, there is no test that gives the definitive diagnosis of appendicitis; the examiner's history and physical exam skills must be relied upon to rule out the diagnosis if a patient is to be discharged safely. A few simple, but very important, steps should be taken to reduce the risk of missing an inflamed appendix.

In the case described here, the patient left the ED with a diagnosis of gastroenteritis despite a lack of vomiting and current diarrhea. Besides the obvious problem of applying the label of gastroenteritis without the classic historical features needed to support the diagnosis, there is the possibility that this diagnosis is a sign of impending trouble, both medical and legal. Labeling a patient with gastroenteritis has been cited as a risk factor in patients who ultimately are diagnosed with appendicitis.[30]

Labeling a patient with gastroenteritis may lead to a false sense of security for the patient. Telling the patient that the cause of abdominal pain is a benign, self-limiting condition may suppress the patient's urge to seek further medical care if symptoms become worse or if other symptoms, such as fever or anorexia, develop.[30,31] If a definite diagnosis for abdominal pain can't be made, don't force one on the patient. It is intellectually honest and medically appropriate to diagnose a patient with "abdominal pain of uncertain etiology" if that is, in fact, what the patient has. Such a nonspecific diagnosis also may help convey the need to return to either the ED or another physician if symptoms worsen.

Other risk factors present for missed appendicitis in this case include the presence of pain without nausea and/or vomiting, and no definitive follow-up plan for the patient to be seen 12-24 hours after discharge from the ED. Each of these factors individually has been shown to increase the risk of missed appendicitis in the ED.[30]

Missed Orthopedic Injury. A 54-year-old female was walking down a set of stairs onto a beach when she fell on her outstretched right arm. She immediately had pain in the right shoulder and presented to a local ED. Examination showed extremely limited and painful range of motion in the right shoulder. Neurovascular examination was documented as normal. Anteroposterior position (AP), lateral, and scapular Y-view x-rays were obtained, and were interpreted as normal. The patient was diagnosed with a shoulder sprain, her arm was placed in a sling, and the EP referred her to her primary care physician for follow-up. At follow-up a week later, her physician noted persistent pain and limited range of motion in the shoulder. She was referred to a physical therapist for range of motion exercises without any improvement of symptoms. After eight weeks of physical therapy failed to result in improvement, the patient was referred to an orthopedic surgeon, who obtained an axillary lateral x-ray showing a posterior glenohumeral dislocation. The patient subsequently required total shoulder arthroplasty.

Discussion. Orthopedic injuries are the No. 1 source of lawsuits in EM.[1,4,32] However, because they generally are low dollar-amount cases, these claims represent only 15-20% of total claims paid.[4] Missed dislocations and fractures are rare, but unfortunately are a distinct possibility in any ED. One pitfall clinicians fall into is placing the value of a negative radiograph above historical or physical examination findings. A high index of suspicion must be maintained with all orthopedic injuries, regardless of the x-ray findings. The astute clinician must guard against occult fractures, especially in areas that are notoriously difficult to image completely, such as in the carpal bones of the wrist and metacarpal bones in the foot. A number of orthopedic conditions fall into this "pitfall" category,

including closed tendon injuries in the hand, lunate and perilunate injuries, pediatric forearm fractures, and compartment syndrome.[33-36] The classic example given is scaphoid fracture; it is estimated that in 10-15% of cases, this diagnosis cannot be made based on initial radiographs.[37] If not treated properly from the outset, these fractures have a high rate of non-union or avascular necrosis, which can result in chronic pain or disability.

Another common example of missed orthopedic injury is in cases of growth plate disruption in skeletally immature patients.[38] The EP should be wary of the diagnosis of "sprain" in general, but especially so in this group. Frequently, radiographs of these injuries are unrevealing, leading the examiner to incorrectly conclude that no bony injury has occurred. Orthopedic injuries in this patient population should be treated as Salter-Harris fractures until proven otherwise, with splinting, elimination of weight-bearing on the affected bone, and clear directions for orthopedic follow-up.[38]

Finally, posterior shoulder dislocation can be a difficult diagnosis to make, with estimates that it initially is missed 40-80% of the time.[39] As with most diagnoses, the clinician needs to be aware of its possibility to make the diagnosis. The history usually reveals a fall on an outstretched arm, and the physical exam demonstrates a painful shoulder with limited range of motion, particularly in external rotation. The key to diagnosis is appropriate radiographs. An axillary lateral view is key in viewing the relationship of the glenoid to the proximal humerus.[39] Delay in diagnosis greatly increases the likelihood of requiring shoulder replacement.[39]

Missed Meningitis. A 10-week-old, previously healthy, term infant is brought to the ED by her parents because she is "congested, fussy, and won't go to sleep." The parents relate that she has felt hot to the touch all afternoon, but have not taken her temperature because they do not own a thermometer. An older sibling has had a recent upper respiratory infection, but never had fever. On examination, the child's temperature was 101°; this was attributed to bundling, so the child was unwrapped from her blankets. A repeat temperature taken 30 minutes later was 100.9°F. The child was irritable but consolable, and would not take a bottle. This was attributed to some nasal congestion causing difficulty with feeding. The right tympanic membrane was mildly erythematous, but the examination otherwise was unremarkable. A diagnosis of right otitis media was made, and the child was given a prescription for amoxicillin and instructions to follow up with the pediatric clinic in 7-10 days.

When the patient returned to the ED six hours later, after developing seizures at home, she was found to be in shock. A lumbar puncture (LP) was performed, and the diagnosis of pneumococcal meningitis was made. Despite antibiotics and aggressive care in the pediatric intensive care unit, the patient died 36 hours later from overwhelming pneumococcal sepsis.

Discussion. Missed pediatric meningitis represents 3-5% of malpractice cases in the ED, but accounts for up to 18% of liability dollars expended.[4] This makes it the highest cost-per-claim diagnosis in EM malpractice cases.[4] Classic signs and symptoms of meningitis often are lacking in children younger than 2 years.[40] Clues to the diagnosis in infants frequently are subtle, and include irritability, poor feeding, lethargy, temperature instability (high or low), vomiting, and respiratory distress.[41]

The classic "septic work-up" for fever in children younger than 2 months rarely is disputed, with blood, urine, and cerebrospinal fluid cultures being mandatory, usually followed by admission to the hospital for intravenous antibiotics.[41,42] After 2 years of age, most clinicians feel that patients' signs and symptoms become more reliable and are useful in guiding evaluation. It is the ages in between, 2 months to 2 years, when there is more discretion on the part of the EP as to how far a workup should proceed. The clinician needs to maintain a high level of suspicion and a low threshold for aggressive evaluation of any patient in this range who presents with a history of physical examination that is consistent with meningitis. Pitfalls in evaluation of these patients include discounting symptoms of fussiness or irritability, discounting fevers documented at home or ascribing them to other causes (e.g., bundling), and ascribing all symptoms to minor physical exam findings (e.g., the "red ear"). The primary pitfall that awaits the EP in the treatment of these cases is delaying antibiotics for any reason (e.g., if the LP is to be delayed, treat immediately with antibiotics and perform LP as soon as is feasible).

Conclusion

The practice of EM involves risk. These risk areas, however, can be managed in appropriate fashion, thereby reducing the danger of unwanted medical and legal outcomes.

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Physician CME Questions

To earn CME credit for this issue of Emergency Medicine Specialty Reports, *please refer to the enclosed Scantron form for directions on taking the test and submitting your answers.*

1. The four elements that must be proved to demonstrate medical malpractice include all of the following *except*:
   A. duty.
   B. breach.
   C. causation.
   D. premeditation.
   E. damages.

2. The skill and care that would be provided by a prudent physician in the same specialty under similar circumstances is called:
   A. breach of duty.
   B. causation of damages.
   C. standard of care.
   D. statute of limitations.

3. A statute of limitations:
   A. caps the dollar amount on medical malpractice damages.
   B. limits the time a plaintiff has to bring a lawsuit.
   C. limits monetary awards to nominal damages and excludes punitive damages.
   D. does not apply to medical malpractice cases.

4. Besides medical care rendered, other factors that may contribute to the decision to bring a lawsuit include:
   A. behavioral skills.
   B. interpersonal skills.
   C. communication skills.
   D. All of the above

5. Specific interpersonal skills that can improve a physician's interaction with a patient and family include:
   A. sitting down with the patient.
   B. apologizing for wait times.
   C. attending to creature comforts.
   D. All of the above

6. Discharge instructions should:
   A. be time-specific.
   B. be action-specific.
   C. be suited to the patient's education level.
   D. specifically address secondary issues, such as return to work.
   E. All of the above

7. Patient populations at risk for missed myocardal infarction include all of the following *except:*
   A. middle-age, Caucasian males.
   B. the elderly.
   C. women.
   D. ethnic minorities.

8. The primary pitfall for the EP in the treatment of pediatric meningitis is delay of antibiotic administration.
   A. True
   B. False

In Future Issues: HIV

CME Objectives

After completing the program, participants will be able to:

• Understand and recognize the conditions/situations described and their importance to the practice of emergency medicine;

• Be educated about necessary diagnostic tests and how to take a meaningful patient history;

• Understand the role of risk management in the ED setting and the importance of those subjects both to physicians and patients;

• and provide patients with any necessary information.