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Trauma in Older Patients

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Traumatic injury often is cited as a major cause of mortality in younger individuals.[1,2] It is the most frequent cause of death in persons younger than age 44.[3] The significance of trauma in older age is acknowledged less often. Nonetheless, it is an important topic because trauma is the eighth leading cause of death in patients older than age 65.[4]

Advances in treatment of major illnesses such as arthritis, diabetes, and cardiovascular disease have translated into greater longevity and better health among the older population. Their greater mobility and physical activity have subjected elders to increasing risk of traumatic injury. Persons older than age 65 are less apt to be injured than those in younger age groups.[5] Nevertheless, the injuries they sustain are more likely to lead to a fatal outcome, with increased mortality for given levels of injury than in younger patients.[6]

Moreover, the geriatric segment of the population is growing. Information from the 2000 census indicates that there are now more than 31 million people older than age 65 in the United States.[7] Projections indicate that the population will include 52 million in that age group by the year 2020, and 68 million by the year 2040.[8] Elsewhere in the developed world, the trend is similar. In Europe, individuals older than age 65 constitute 15% of the total population, with this figure expected to reach 30% by the year 2030.[9] However, growth in the elderly population is projected to be greatest in Asia, Africa, Latin America, and the Middle East.[10]

Older patients also consume a disproportionate amount of health care resources. Though they constitute only 14% of the United States population, they utilize one-third of all trauma health care dollars.[11] Elderly patients also are more likely than younger trauma victims to require hospitalization, and their hospital stays tend to be longer and be attended by more complications.[8]

This issue will review the unique aspects of care of the older trauma patient.

— The Editor

Introduction

Older patients often are subdivided into groups of those age 65-80 years and those older than 80 years. This distinction has clinical relevance, inasmuch as patients in the latter group have a significantly poorer outcome when injured.[6,12] Nearly half of patients older than age 80 die following a degree of trauma that will kill only 10% of patients ages 65-79 years. This increased

mortality is primarily due to cardiac, pulmonary, and septic complications.[6] Overall, however, age alone is not a good predictor of outcome or quality of life after hospital discharge.[12]

Increasing age narrows the physiologic reserve of patients. This limited reserve easily can be exceeded when the older patient is injured. Death in older patients in the 24 hours following trauma is due most likely to post-injury cardiovascular limitations.[8] Among those who survive the initial hemodynamic stress of injury, deaths more likely relate to impaired pulmonary or immunologic reserves.[13]

There is some controversy regarding the accuracy with which mortality can be predicted for this population. There are studies that indicate a good correlation between Injury Severity Score (ISS) and outcome in the elderly.[14-16] Other studies have demonstrated that ISS and other anatomic or physiologic scoring systems are not accurate in predicting mortality in this group.[1,11] Although certain conditions (e.g., sepsis) are associated with a poor outcome in the elderly trauma patient, some of these conditions are not apparent at the time of initial presentation.[8]

Mechanism of Injury

Older patients are predisposed to injury partly because of a qualitative diminution in the senses. Age-related deterioration of hearing and eyesight are important factors. In addition, imbalance, poor coordination, and muscular weakness may further reduce the older person's ability to cope with injury hazards. Falls are the most common cause of injury in the elderly population, followed by motor vehicle collisions, thermal injuries, and assault. *(See Table 1.)*[16] Older women have higher rates of injury from falls than do men, whereas men have higher rates of injury from motor vehicle collisions and burns.[5]

Falls account for approximately 40% of injury deaths in individuals older than age 65.[17] A fall is defined as an unintentional loss of balance that leads to a failure of postural stability. It has been estimated that 30% of persons older than age 65 who live in the community fall each year.[18,19] Higher fall rates are reported among persons living in long-term care institutions. Moreover, the incidence of falls increases progressively with age, from 30% per year at age 65 to 45% after age 80, and to 56% after age 90.[20] Half of patients who fall do so repeatedly.

It is estimated that 5% of falls by elderly persons result in fractures, with a similar number resulting in serious soft-tissue injuries.[21] The severity of injury produced by falls depends on a number of factors, including the height of the fall, the force of impact, the landing surface, the presence of osteoporosis, female gender, and age older than 75 years.[18]

The causes of falls are multi-factorial, and can be broadly categorized as intrinsic (age- and disease-related) and extrinsic (environmental hazards, such as slippery surfaces, loose rugs, and objects on floors). Extrinsic factors are most frequently cited as being responsible for falls, but it may be that many falls described as accidents actually represent interactions between identifiable environmental hazards and increased susceptibility to loss of postural stability. Most falls in the elderly are thought to be pathologic rather than truly accidental.[22]

An effort should be made, based upon historical information and physical examination, to determine the role played by intrinsic factors in producing a fall. Important causes include cardiac dysrhythmias, hypovolemia, orthostatic hypotension, carotid sinus hypersensitivity, parkinsonism, and vertebrobasilar insufficiency. *(See Table 2.)* As important as the presence of individual risk factors is the synergism among multiple risk factors. The risk of falling increases as the number of risk factors rises.[23]

Table 1. Causes of injury in Older Trauma Patients[16]

- Falls
- Motor vehicle collisions
- Thermal injuries
- Assault
- Pedestrian injuries
- Gunshot wounds
- Suicide attempts
- Abuse

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Table 2. Medical Causes of Falls

DISORDERS OF GAIT

- Muscular weakness
- Arthritis
- Impaired sensation
- Diminished proprioception
- Parkinsonism

ORTHOSTATIC HYPOTENSION

- Hypovolemia
- Autonomic dysfunction
- Anemia

SYNCOPE AND NEAR-SYNCOPE

- Cardiac dysrhythmias
- Pacemaker failure
- Aortic stenosis
- Carotid sinus hypersensitivity

OTHER CAUSES

- Vertebrobasilar insufficiency ("drop attacks")
- Visual impairment
- Hypoglycemia
- Medication effects

Table 3. Evaluation of the Older Patient Sustaining a Fall

HISTORY

- Circumstances of fall
- Acute or longstanding medical problems
- Medications
- Mobility level

PHYSICAL EXAMINATION

- Vision
- Gait
- Balance
- Lower extremity joint function
- Cardiovascular system
  - Heart rate
  - Postural pulse and blood pressure
- Neurologic function
  - Mental status
  - Cortical function
  - Muscular strength
  - Extrapyramidal function
  - Lower extremity peripheral nerves
  - Proprioception
  - Reflexes
  - Coordination

Other medical factors associated with falls are disorders of gait, balance or proprioception, poor vision, impaired mental function, and use of psychotropic drugs.[20] The use of benzodiazepines, phenothiazines, and antidepressants is associated with falling, independent of other risk factors.[21] These agents predispose users to falls by producing dizziness, psychomotor slowing, or ataxia.[19] Other commonly prescribed medications that can produce these effects include antihypertensives, diuretics, and anti-parkinsonian agents.

Practice guidelines for fall assessment have recently been formulated by the American College of Emergency Physicians,[24] the American Geriatrics Society, the British Geriatrics Society, and the American Academy of Orthopedic Surgeons.[23] Table 3 outlines the approach recommended by the latter groups for evaluating older persons who present subsequent to one or more falls.[23]

Traffic collisions are another important mechanism of injury. Elderly drivers operate vehicles for fewer miles than do younger ones, but when the groups are normalized for the number of miles driven, the elderly have a higher rate of collision than any other age group except new drivers.[5] Those older than age 85 have the highest per-mile crash rate of all age groups.[3] This has been attributed to impaired driving skills and syncopal episodes that occur during driving.[1]

The elderly have a high injury and fatality rate from these events.[5] Moreover, they are likely to be responsible for the crash in which they are involved.[25] Older drivers are more likely to be injured in intersection and turning crashes, and in head-on collisions in urban areas. Conversely, they are less likely to be victims in single vehicle crashes or to be cited for reckless driving, speeding, or driving while intoxicated.[26]

The regulatory approaches of different states to driving licensure of older individuals are varied. Some states have increased the requirements for this group, such as prohibiting license renewal by mail after a certain age, or requiring road or vision tests. Conversely, other states specifically prohibit such discrimination by age. North Carolina actually relaxes its testing laws for older individuals with respect to parallel parking.[27]

Older pedestrians frequently are injured by being struck by vehicles. For persons ags 65 years and older, pedestrian injuries account for 22% of traffic-related deaths.[26] This has been attributed to diminished motor strength and speed, and decreased visual acuity. The majority of elderly pedestrians who are injured are struck at intersections rather than between intersections.[5,28] Crosswalk signals assume an ambulatory crossing speed of four feet per second, a rate the elderly may not be able to maintain.

The majority of elderly trauma patients are victims of blunt trauma. There is, however, a small percentage (5-10%) who suffer penetrating injuries.[29] The incidence of this mechanism of injury has been increasing in some urban areas.[29]

Although suicide often is considered a younger person's problem, the highest rates of suicide are seen in men ages 75 years and older.[30,31] Those older than age 85 have two- to threefold greater suicide rates than do adolescents and young adults.[26] Rates of intentionally self-inflicted firearm injury are higher among men older than age 65 than in any other age group.[32]

Initial Assessment

The American College of Surgeons Advanced Trauma Life Support guidelines recommend that age be taken into consid-

Table 4. Physiologic Alterations Due to Aging

Cardiovascular
- Decreased cardiac output
- Ischemic coronary disease
- Conduction system disturbance
- Decreased catecholamine sensitivity

Immune system
- Diminished humoral immunity
- T lymphocyte dysfunction

Musculoskeletal
- Osteoporosis
- Decreased muscle mass

Neurologic
- Diminished vision
- Diminished hearing
- Cerebral cortical atrophy

Renal
- Reduced renal function
- Decreased urinary concentration

Respiratory
- Decreased pulmonary compliance
- Reduced vital capacity
- Decreased forced expiratory volume

eration when making triage decisions for trauma patients.[2] Initial evaluation of the injured elderly patient otherwise should differ little from the standard trauma evaluation. As in a patient of any age, prompt identification of injuries and sources of bleeding is important. A detailed past medical history must be obtained, inasmuch as many older patients have chronic medical conditions and may be maintained on medication regimens. Underlying illnesses such as osteoporosis increase the likelihood of injury resulting from even minor mechanisms. Illnesses more likely to be present in older patients (especially ischemic heart disease, diabetes, and chronic obstructive pulmonary disease) are factors in increased mortality in trauma victims.[33]

In contrast to the younger patient, shock in the elderly is less likely to reflect only hemorrhage. Cardiac insufficiency induced by hypovolemia likely is a factor. Non-cavitary hemorrhage (e.g., caused by bleeding at fracture sites or from lacerations) is more likely to be a significant contributor to shock in the elderly.[34]

There is some evidence that initial clinical assessment regularly underestimates the severity of injury in older patients.[35] Although tachycardia often is cited as a reliable early sign of hemorrhage, this sign may be blunted by cardio-active medications, intrinsic conduction disease, or decreased responsiveness of the older heart to catecholamines.[36]

Although initial blood pressure may be in the normal range in the elderly patient who has sustained blood loss, such seeming stability often is the result of increased systemic vascular resistance. In fact, in older trauma victims, blood loss and decreased cardiac filling pressures inevitably lead to inadequate peripheral oxygen delivery. Moreover, a blood pressure in the normal range may actually represent relative hypotension in the patient with baseline hypertension. Urine output as an indicator of renal perfusion also may be misleading, because elderly patients have a lessened ability to concentrate urine.[36] This is due to age-related diminished sensitivity to antidiuretic hormone.

Invasive pressure monitoring with arterial and pulmonary artery catheters may reveal hemodynamic inadequacy more accurately in these patients. This has led some to advocate a truncated emergency department course for elderly multiple trauma victims, with early transfer to the intensive care unit for invasive monitoring.[35] This approach facilitates early assessment of cardiac output and mixed venous oxygen tension, parameters closely related to survival.[35]

Resuscitation

As previously noted, elderly patients typically lack reserves in multiple physiologic systems. *(See Table 4.)* There is likely to be a decrease in cardiac index, pulmonary compliance, renal function, and ability to regulate fluid balance. Even in the absence of significant coronary artery disease, for example, cardiac output may decline by as much as 50% between ages 20 and 80 years.[3]

Because the older patient often has underlying cardiac or respiratory disease, initial application of supplemental oxygen almost always is indicated. The decision to intubate is a significant one, inasmuch as intubation and mechanical ventilation are attended by an increased risk of barotrauma and nosocomial pneumonia in the elderly.[37] The need for early intubation followed by long-term assisted ventilation is a predictive factor for fatal outcome.[1]

The anatomy of the geriatric airway may differ from that in the younger adult, and these differences may influence the process of endotracheal intubation. The patient may be edentulous, or dentures may be in place. Well-fitting dentures make bag-valve-mask ventilation more effective. All loose-fitting or partial dentures should be removed prior to assisting ventilation. Lack of mobility of the cervical spine, especially at the atlanto-occipital joint, may limit glottic visualization.

When rapid sequence induction is necessary, medication dosage may need to be adjusted. The dose of neuromuscular blocking agents should not be reduced. The doses of induction agents should be reduced to minimize the risk of cardiac depression and hypotension, because the elderly are more sensitive to the effects of these agents. Benzodiazepine, barbiturate, and etomidate dosage should be reduced by 20-40%.[37]

A warm environment should be provided. Elderly patients are particularly prone to hypothermia. Sensitivity to cold may reflect decreased fat stores or a slowed basal metabolism rate.[38] Older patients are extremely intolerant of the adverse effects of shock. Mortality is greatly increased in patients who experience shock even transiently, and it is vital to maintain a normal blood pressure. In one study of patients ages 70 years and older with multiple injuries, all non-survivors had an episode of hypotension in which the blood pressure was lower than 80 mmHg for at least 15 minutes. Of the remainder who survived, only 6% sustained a comparable bout of hypotension.[11]

Shock should be treated aggressively, but rapid infusion of intravenous fluids may result in fluid overload and pul-

Figure 1. Acute SDH

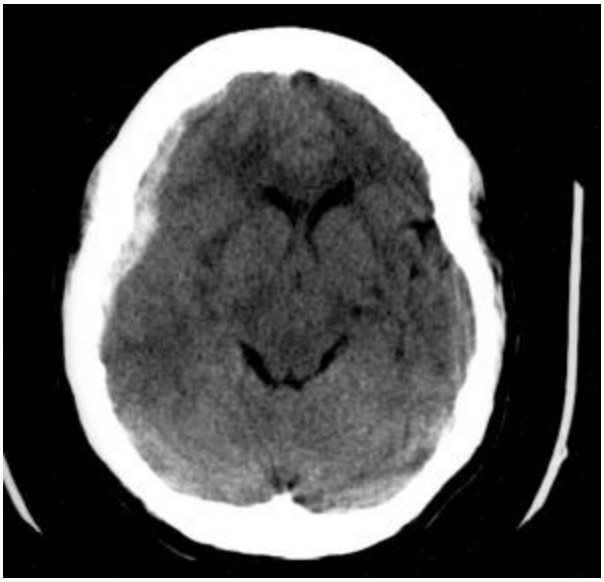
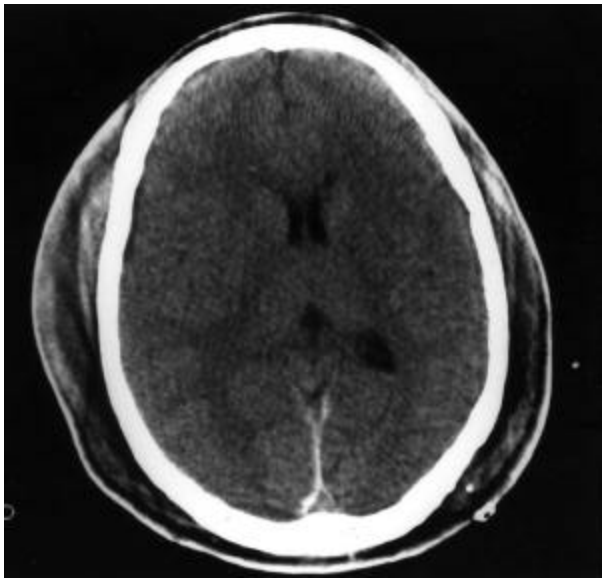


Figure 2. Acute SDH Along Falx



monary edema in patients with limited cardiac reserve. This has led some to recommend multiple, small (e.g., 250 mL) fluid bolus administrations over rapid "wide-open" infusion.[37] Blood product transfusion should be considered early because elderly trauma victims cannot readily increase their cardiac output to meet increased oxygen demands, and depend more specifically on hemoglobin content for tissue oxygen delivery.[36]

Head Injury

It generally is accepted that the outcome from serious head trauma in the elderly is very poor, especially when the patient presents with a Glasgow Coma Scale (GCS) score of less than 8.[9,35,39,40] Older patients who present with a GCS score of 5 or less have an extremely poor prognosis, almost irrespective of the underlying injury.[41] Among elderly survivors of closed head injury there is, moreover, a poor long-term functional outcome.[40]

The reasons for such poor outcome may be related to underlying central nervous system conditions, such as degenerative brain disease. Other possible explanations include increasing neuronal fragility in the elderly, decreased physiologic reserves of other organ systems, and the propensity to pathologic bleeding produced by coagulopathy or thrombocytopenia. As with trauma in general, falls are the major cause of head injury.[41] *(See Figure 1.)*

Subdural hematoma is an entity that becomes more common with increasing age.[42] The mechanism is likely to be a fall or domestic accident, but it may result from an assault or traffic collision. In some cases, a history of trauma is absent. Patients who should be suspected of having a subdural hematoma include those with headache, focal neurologic deficit, gait disturbance, or change in mental status. The latter presentation may be particularly subtle. Aspirin use may be a risk factor to development of subdural hematoma, as are chronic alcohol abuse and use of anticoagulation agents.[43] Liver disease and prostatic malignancy also predispose a patient to subdural bleeding.[44]

Most subdural hematomas result from bleeding emanating from bridging veins passing from the brain to the dura mater. These vessels are more readily disrupted in the elderly because of age-related vascular fragility. In addition, cerebral atrophy may cause pre-stretch of these veins, making them less tolerant to intracranial movement of the brain.[45]

Subdural hematoma has been subdivided into acute, subacute, and chronic forms, depending on the time from trauma. Acute subdural hematoma may result from hemorrhage from small cortical arteries rather than a venous source. *(See Figure 2.)* This entity has a particularly poor outcome in the elderly. In one study, patients younger than age 40 with acute subdural hematoma had an 18% mortality rate and a 66% functional survival rate, whereas mortality was 74% and functional survival rate 9% in persons older than age 65. The older group displayed twice the amount of midline shift and four times the hematoma volume.[46]

In the case of chronic hematomas, the subdural collection may become invested by a membrane that allows for progressive accumulation of subdural fluid by an osmotic mechanism. In addition, the injured dural membrane may develop neovascularizatrion, leading to repetitive bleeding into the hematoma.[45] The consequence may be a prolonged clinical course, with waxing and waning of findings. Computed tomography (CT) is diagnostic, and subdural hematoma sometimes is encountered when CT is ordered to evaluate for the possibility of stroke or as part of the assessment of mental status decline.

Epidural hematoma is encountered less frequently in the elderly.[47] As the brain ages, the dura mater becomes progres-

sively more adherent to the inner surface of the skull. The epidural space thereby becomes obliterated over time.

Thoracic Trauma

Unlike in the younger population, in which males predominate, the number of elderly males and females who sustain blunt chest trauma is roughly proportional. Victims of blunt chest injury are typically subject to multi-system trauma, with 85% of older patients in one series displaying extra-thoracic injuries.[48] Osteoporosis and increased chest wall rigidity contribute to a higher incidence of rib and sternal fractures in older patients.[8] These fractures can, in turn, lead to splinting and hypoventilation. Combined with reductions in vital capacity, one-second forced expiratory volume, and arterial oxygen tension, the result is an increased mortality associated with chest trauma.[48] Consequently, although flail chest of a moderate degree sometimes may be managed without mechanical ventilation in younger patients, this seldom is an option in the elderly.[34]

Pulmonary contusion is less common in older trauma patients because their stiffer rib cage fractures rather than compresses to bruise the lung. When blunt injury to the lung does occur in older patients, greater intra-alveolar and interstitial edema is produced, leading to decreased pulmonary compliance and ventilation-perfusion mismatch.[36]

High-speed deceleration injuries to the chest may damage the thoracic aorta, and the inelasticity of the aorta in older patients makes it particularly vulnerable to transection. Aortic transection is likely a common cause of immediate death following motor vehicle collisions. For patients who survive to hospital evaluation, this represents a particularly challenging entity. There are few characteristic clinical signs that are indicative of aortic injury. Moreover, the presence of significant extra-thoracic trauma may delay identification of a more subtle aortic injury.[49]

Abdominal Trauma

Significant abdominal injuries have been reported in up to 35% of geriatric patients with multiple trauma.[11] Abdominal injuries lead to death in older patients at a rate 4.7 times higher than in younger patients.[14] Signs of intra-abdominal injury, such as those reflecting peritoneal irritation, may be less apparent in the elderly, making the abdominal examination somewhat unreliable. Unexplained hypotension may be the only finding indicating intra-abdominal injury. Abdominal CT with contrast media is important for identifying intra-abdominal injuries in stable patients. However, care must be taken to ensure adequate hydration prior to the study to avoid renal failure induced by intravenous contrast.[50]

Skeletal Injury

The osteoporotic bones of the elderly are particularly vulnerable to fracture subsequent to trauma. Typical fractures related to osteoporosis involve the pelvis, spine, proximal humerus, distal forearm, and hip. Clinical diagnosis of skeletal fracture may be hampered by the older patient's decreased perception and localization of pain.

Pelvic fractures constitute especially lethal injures.[28] When a pelvic fracture is accompanied by hypotension, the mortality rate is nearly 50%.[36] Open fractures carry a substantially greater risk of death than do closed ones.[34]

Compression fractures of the thoracolumbar spine are very common in the elderly.[51] Distinguishing between compression fracture and burst fracture is important, as the latter may be unstable. This distinction may be difficult to see on plain radiographs, and CT or magnetic resonance imaging may be necessary to make the diagnosis.

Cervical spine injuries may be seen in older patients after relatively minor trauma, and have a mortality rate of 26%.[52] There is a high proportion of upper cervical (e.g., odontoid and other C_1-C_2) involvement reported.[52] This area likely is predisposed to higher transferred stresses as a consequence of the relative immobility of a spondylotic lower cervical spine. Careful evaluation of cervical spine radiographs, especially the open-mouth view of the odontoid, is imperative in older patients. The standard principles of managing spinal injury apply to older patients. Unfortunately, older patients have a higher incidence of sustaining permanent neurologic deficit, as well as incurring serious post-injury complications, such as pulmonary embolism, pneumonia, and gastrointestinal bleeding.[53]

Of the incomplete traumatic cord syndromes, the most common is the central cord syndrome.[54] The high incidence of such injury likely is due to spondylosis and relative spinal canal stenosis.[52] Central cord syndrome is characterized by greater involvement of the upper extremities compared to the lower extremities, varying degrees of sensory loss below the level of the injury, and bladder dysfunction (usually manifested as urinary retention). Neurologic deficits tend to be more severe and prognosis poorer with this syndrome in the older group than in younger patients.[53]

Humerus fractures occur frequently in the elderly, with proximal fractures accounting for 30% of upper extremity fractures.[51] Because the cancellous bone of the humeral neck is relatively weaker than the surrounding ligaments, a mechanism likely to produce a dislocation in a younger individual results in fracture in the geriatric patient. Women sustain such injuries twice as frequently as men. Rotator cuff tears also are common in elderly individuals, with a fall onto an outstretched arm being the usual mechanism of injury.[36] This mechanism also produces the dorsally displaced distal radius fracture. These fractures are probably the most frequent type involving the upper extremities.

Approximately 340,000 hip fractures occur annually in the United States.[55] These are the most common major fractures of the lower extremity, and are the most frequent reason for admission of elderly trauma victims.[3] The mechanism of injury typically is a fall from standing height. The high incidence in the elderly is due largely to age-related reduction in bone strength of the femoral neck. Only a minority of hip fractures (about 10%) are due to high-speed trauma or specific lesions in the proximal femur.[10]

Table 5. Factors Commonly Associated with Poor Outcome in the Geriatric Trauma Patient

- Advanced age
- Increasing severity of injury
- Shock
- Prolonged mechanical ventilation
- Male gender
- Significant head injury
- Sepsis

Table 6. Death Rate for Geriatric Trauma Patients

YEAR	AGE GROUP		
	65-74 years	**75-84 years**	**85 years and older**
1999	45.1 *	101.1	280.9
1996	47.0	102.0	276.2
1979	58.8	117.8	276.0

* Rates based on annual basis per 100,000 population.
Adapted from National Vital Statistics Reports from the Centers for Disease Control and Prevention, 1979-1999.

The incidence of hip fracture is higher in women than in men, and higher in white than non-white populations.[56] Those living in institutional settings are at increased risk compared to those living in private homes.[57] Mortality rates associated with hip fractures range from 13% to 30% within the first year of injury.[51] Mortality increases with age.[58] The problem of hip fracture has led to injury-prevention strategies, such as advocacy of at-risk patients wearing hip protectors[59] and administration of vitamin D and calcium supplements.[60]

Elderly pedestrians struck by cars have a high incidence of open tibial fractures.[61] Closed tibial plateau fractures also may result from vehicular trauma or falls. In older patients, the lateral tibial plateau will fracture before excessive stress is placed on the medial knee ligaments. Lateral plateau fractures may be difficult to see on standard radiographic views of the knee, and oblique radiographs or CT scans may be necessary to make the diagnosis.

Soft Tissue Injury

The aged skin is delicate and atrophic, with a thinner dermis. Consequently, it is easily damaged. Epithelial replacement and proliferation also decrease with age.[62] Diminished immune responses increase the likelihood of wound infection and tetanus.

The incidence of burns in the elderly is lower than that in younger individuals.[63] The elderly are, nonetheless, disproportionately affected by burns, being much less likely than younger persons to survive serious burns.[64] Burns account for about 8% of injury-related deaths in the elderly.[65] Whereas a person age 35-49 years has about an 80% chance of surviving a 40% body surface area burn, the survival rate drops to 30% for those in the age range of 60-74 years, and to 6% in persons older than age 74.[9] Geriatric patients with greater than 70% body surface area burns are unlikely to survive even with the most aggressive management.[3,62]

The most frequent types of thermal injuries in the elderly are scalds, flame burns, and contact burns. Nearly all such injuries occur in a residential setting.[26] Scalds are the most common form of burn, often resulting from contact with hot tap or bath water.[63] A number of factors may cause the older burn victim to sustain deeper injury, including impaired sensation and slower reaction time.

Outcome

Mortality from most major forms of trauma has declined overall with the advent of improvements in assessment and therapy.[41] The outcome logically to be expected in seriously injured older patients, however, is in some dispute. In a study by Oreskovich, the conclusion reached was that the potential for full recovery was poor in this population. Of the patients studied, 72% of those who survived serious trauma were confined to nursing homes a year after hospital discharge.[11] Other studies have found a better quality of survival. In one assessment, 89% of older trauma survivors were ultimately discharged home from the hospital.[66]

The dreary outlook for elderly patients with severe head injury already has been noted. Moreover, the age-mortality relationship is not linear, with mortality risk rising abruptly beginning in the seventh decade.[41] *(See Tables 5 and 6.)* Elderly victims of penetrating trauma have a higher mortality and longer hospital and intensive care unit stays than comparable younger patients. However, they do nearly as well as their younger counterparts, with a high rate of discharge from the hospital.[29]

Unlike short-term mortality, long-term survival in elderly trauma victims has not been studied extensively. In one recent study, the quality of long-term survival has been found to be reduced when compared to age-matched controls.[67] This was thought to be due in part to decline in functional status resulting from injury. The recommendation was that aggressive management of these patients must extend beyond the immediate post-injury phase of treatment.[67]

Elder Abuse

The issue of elder abuse is closely associated with that of trauma in the elderly. Frequent consequences of abuse include head injuries, fractures, sprains, bruises, abrasions, and other wounds. Although the most restrictive definition of elder abuse is limited to acts of violence, the elderly also are victims of subtler mistreatment. The diagnosis is sometimes difficult, because the natural history of chronic diseases as well as the inclination of the elderly to fall may be confused with abuse.

Efforts to estimate the incidence of elder abuse have met with a number of methodological obstacles. Among these is the absence of a generally accepted definition of the condition.

Given these limitations, it nonetheless is estimated that 1-2 million elderly patients in the United States experience mistreatment annually.[68] Of cases reported, physician reports account for only 2%.[69]

No consistent picture of the at-risk patient has emerged. Early studies suggested that those most likely to be victims of abuse were women who were frail, cognitively impaired, and had multiple chronic illnesses. More recent work has failed to find differences in prevalence of elder abuse between men and women, the frail and vigorous, and the cognitively impaired and intact.[70] A common setting is a caregiver overtaxed by the requirements of caring for a dependent adult.[71]

Various aspects of the presentation should alert the clinician to the possibility of elder abuse. The diagnosis should be considered when an older patient presents with multiple injuries in various stages of evolution. Signs of neglect include evidence of poor hygiene, malnutrition, and skin breakdown. As with child abuse, a clue might be a pattern of injury inconsistent with the mechanism described. A caregiver who serves as surrogate historian may provide implausible explanations for injury or describe the patient as being "accident-prone." Patients who have long delays between injury and the time of presentation for care, and those who have frequent emergency department visits also may raise suspicion. Assessing the patient with dementia for the possibility of elder abuse may be particularly challenging. *(See Table 7.)*

Forty-two states have mandatory reporting laws requiring health care workers to report suspected abuse to state adult protective service agencies. In many of these states, suspicion alone constitutes grounds for filing such a report, and many statutes grant immunity to physicians who report such suspicion in good faith.[68] In the remaining eight states, reporting is voluntary.[69]

The elderly abuse victim considered to be in immediate danger should be separated from the abuser whenever possible. Hospitalization may be necessary on this basis. This is similar to the action frequently taken in suspected child abuse cases. The situation is considerably more complex than in child abuse, though, because the mental competence of the older adult may be at issue. The older person has a right to refuse protective services (absent a court order determining incompetence), unlike the child, for whom the government maintains a right to intervene. The case of a competent elderly person who insists on remaining in an abusive environment may be especially troublesome.

Ethical Issues

It is clear that the outcome for many elderly trauma victims is not favorable. Given the poor prognosis for many such patients, ethical questions logically may be raised regarding the appropriate vigor of resuscitation. Many authors have advocated that, as a rule, aggressive initial resuscitation be instituted.[29,36,66,72] Indeed, given the small margin for error in these patients, to act otherwise would likely doom them. Only aggressive support in the early treatment phase is likely to result in salvage of the severely injured older patient.[35]

Although conditions associated with poor outcome and death have been pointed out, many of these do not become apparent until later in the hospital course. Ethical dilemmas regarding withdrawing treatment may present during this time, and the patient's and family's wishes as well as the contents of advance directives will need to be incorporated into management decisions.

Table 7. Guidelines for Questioning Older Adults about Possible Abuse

- Has anyone at home ever hurt you?
- Has anyone ever touched you without your consent?
- Has anyone ever made you do things that you didn't want to?
- Has anyone ever scolded or threatened you?
- Are you afraid of anyone at home?
- Are you alone a lot?
- Has anyone ever taken anything of yours without asking?
- Have you ever signed any documents that you didn't understand?
- Has anyone ever failed to help you take care of yourself when you needed help?

Adapted from: *Diagnostic and Treatment Guidelines on Elder Abuse and Neglect.* Chicago, IL: American Medical Association; 1992.

Summary

Injury in older patients is an important issue. Trauma is the eighth leading cause of death in patients older than 65 years of age. Although patients in this age group are less likely to be injured than younger individuals, the injuries they sustain are more likely to lead to a fatal outcome or to require longer and more complicated hospitalizations. Falls are the most common cause of injury in the elderly population, followed by motor vehicle collisions, burns, and assault.

Increasing age narrows the physiologic reserve of patients, and this limited reserve can be exceeded when the older patient is injured. Cardiac, pulmonary, and immune system deficiencies, in particular, lead to poor tolerance of traumatic insult. There are a number of characteristic features of trauma in the elderly. For example, there is a high incidence of bony fractures attributable to osteoporosis and a high risk of adverse outcome with head injury.

The outcome logically to be expected in seriously injured older patients is in some dispute. Consequently, aggressive initial resuscitation should be instituted in these patients. Initial clinical assessment often appears to underestimate the severity of injury in these trauma victims. Early transfer to the intensive care unit for invasive monitoring may be warranted.

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CME Questions

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

1. The most common cause of injury in older patients is:
   A. motor vehicle collisions.
   B. pedestrian crossing trauma.
   C. tap water scalding.
   D. falls.

2. Tachycardia as a sign of blood loss may be absent in the elderly because of:
   A. pacemaker failure.
   B. increased responsiveness to catecholamines.
   C. decreased responsiveness to catecholamines.
   D. decreased responsiveness to calcium channel blockers.

3. When performing rapid sequence intubation in older patients, which of the following adjustments should be made?
   A. Reduce the dosage of induction agents.
   B. Reduce the dosage of neuromuscular blocking agents.
   C. Adjust the dosage of both induction and neuromuscular blocking agents, in accordance with renal function.
   D. No adjustment in medication dose is necessary.

4. Which of the following entities becomes more common with increasing age?
   A. Traumatic subarachnoid hemorrhage
   B. Epidural hematoma
   C. Subdural hematoma
   D. Cerebral concussion

CME Objectives

Upon completing this program, the participants will:

a.) Be able to quickly recognize or increase index of suspicion for traumatic injuries in the older patient;
b.) Be educated about how to quickly resuscitate, stabilize, and manage the older trauma patient;
c.) Be aware of ethical issues that may arise after traumatic injury to an older patient;
d.) Be aware of recommended methods to question suspected victims of elder abuse; and
e.) Understand both likely and rare complications that may occur as the result of traumatic injury to an older person.

5. Osteoporosis and increased thoracic wall rigidity in older patients contribute to a greater incidence of which of the following?
   A. Tracheal disruption
   B. Aortic transection
   C. Pulmonary contusion
   D. Rib and sternal fracture

6. Which of the following is the most common partial cervical spinal cord injury in older patients?
   A. Central cord syndrome
   B. Anterior cord syndrome
   C. Brown-Sequard syndrome
   D. Posterior cord syndrome

7. Which of the following is suggestive of elder abuse?
   A. Acute multi-system injury
   B. A history of injury by a caregiver that is inconsistent with clinical findings
   C. A history of dementia
   D. A new caregiver unfamiliar with a patient's past medical history

8. Initial resuscitation of the elderly trauma victim should be:
   A. cautious, in light of the poor outcome to be expected in these patients.
   B. aggressive, with early use of invasive monitoring considered.
   C. aggressive, with primary dependence on clinical vital signs.
   D. withheld until the content of advance directives is known.

9. Which of the following is true regarding abdominal trauma in the elderly?
   A. Significant abdominal injury is reported in 80% of geriatric patients with multiple trauma.
   B. Peritoneal irritation may be less apparent in the elderly.
   C. Stable patients require exploratory laparotomy.
   D. Abdominal injuries lead to death in older patients at a rate 1.5 times higher than in younger patients.

10. Which of the following skeletal injuries is particularly lethal?
   A. Proximal humerus fracture
   B. Hip fracture
   C. Pelvic fracture
   D. Compression spine fracture

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