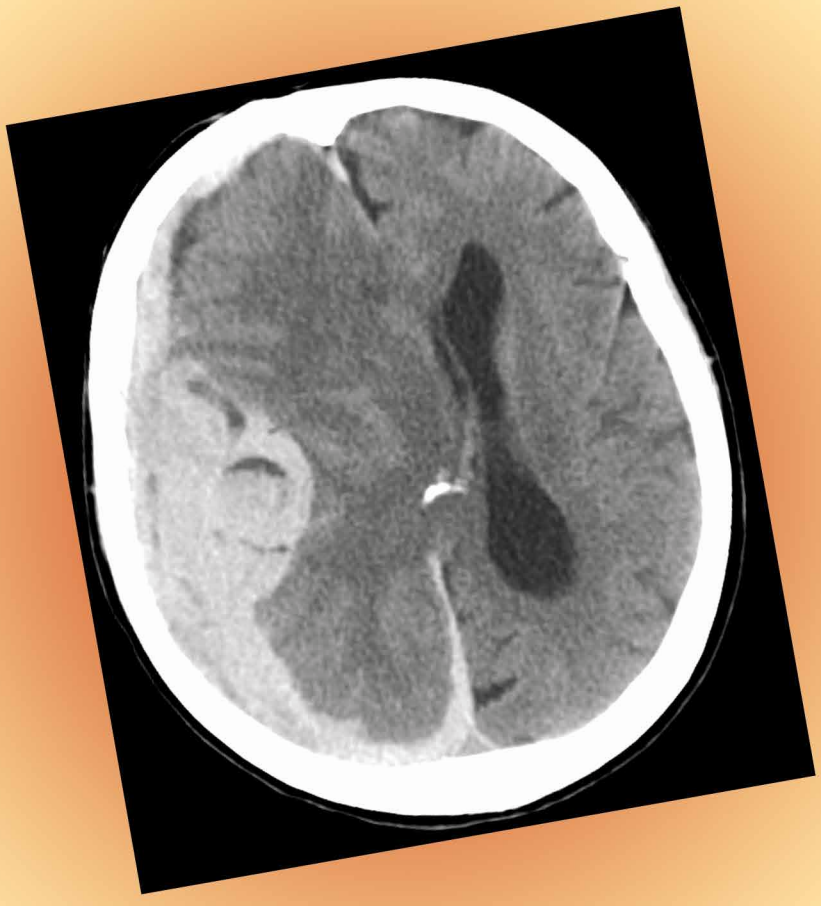

Geriatric Trauma Patients and Altered Mental Status

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Through a case presentation and results of a retrospective chart-review study, the authors outline common causes of trauma and altered mental status in geriatric patients.

Case

A 76-year-old woman presented to the ED with right rib pain after tripping on a rug and sustaining a fall down the stairs in her home. The patient's chart review showed a history of multiple falls over the past year, with injuries including left rib fracture, right distal radius fracture, ankle sprain, forehead contusion, and left hip contusion. Regarding her social history, the patient denied any alcohol or drug use. She was not on any prescription medications and had no known medication or food allergies.

The physical examination was notable for a thin, white female in no apparent distress. The patient's vital signs at presentation were: temperature, 97.2°F; blood pressure, 110/78 mm Hg; heart rate, 110 beats/minute; respiratory rate, 24 breaths/minute. She was somnolent but arousable and oriented to person, place, and time. The right chest wall was tender, and her lungs were clear to auscultation. The cardiac and neurological examinations were within normal limits. The patient had multiple contusions of various stages of healing over all extremities.

Introduction

Geriatric patients aged 65 years and older represent a large, growing segment of the US population and, according to US Census Bureau data, represent an estimated 14% of the population.[1] Moreover, this population accounts for 36% of all ambulance transports, 25% of hospitalizations, and 25% of total trauma costs.[2] Although geriatric patients are less likely to be involved in trauma compared with other age groups, they are more likely to have fatal outcomes when injured. Approximately 28% of deaths due to accidental causes involve persons aged 65 and older. The highest mortality rates from trauma are noted in patients in the 8th decade and older.[3]

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Table 1. Altered Mental Status Among Trauma Patients

Etiology	Diagnostic Tests
Trauma	
Intracranial hemorrhage	CT of brain, noncontrast
Shock/Hypovolemia with hypotension	Blood pressure
Metabolic etiologies	
Electrolyte abnormality	Serum chemistry panel
Hypoglycemia	Point-of-care glucose
Hyperglycemia	Point-of-care glucose
Hyperammonemia	Serum ammonia level
Hypoxia	Pulse oxygenation
Uremia	Serum chemistry panel
Medication/Drugs	
Alcohol intoxication	Alcohol level
Illicit drug use (opiates, cocaine, marijuana, benzodiazepines, other)	Toxicology screen
Pharmaceutical adverse effects (narcotics, benzodiazepines, etc)	History and physical examination
Withdrawal syndromes	History and physical examination
Malignancy	
Intracranial mass	CT of brain
Seizure	EEG, serum lactate
Endocrine	
Hypothyroidism	TSH, Free T4
Hyperthyroidism	TSH, Free T4
Adrenal insufficiency	ACTH stimulation test
Temperature	
Hypothermia	Temperature
Hyperthermia	Temperature
Psychiatric Conditions	History and physical examination

Abbreviations: ACTH, adrenocorticotropic hormone; CT, computed tomography; EEG, electroencephalogram; T4, thyroxine; TSH, thyroid-stimulating hormone.

Mechanism of Injury and Preexisting Conditions

Falls are the most common mechanism of injury in patients over age 65 years,[4] and mortality as a result of falls increases with advanced age.[5] In addition to the increased risk of trauma, comorbid diseases are also common in this population and include diabetes mellitus, coronary artery disease, arthritis, renal disease, and pulmonary disease.[6]

The presence of preexisting conditions, which affect a patient's physiological age, is associated with increased mortality rates.[7,8] As with other age groups, outcomes for geriatric trauma patients can

Table 2. Mode of Arrival and Mechanism of Injury of 144 Geriatric Trauma Patients[10]

Variable		N	%
Mode of arrival	Walk-in	5	3.47
	Ambulance	101	70.14
	Helicopter	38	26.39
Injury mechanism	Assault	3	2.08
	Motorcycle accident	1	0.69
	Fall	106	73.61
	Motor vehicle collision	26	18.06
	Other	7	4.86

also be predicted using the Injury Severity Score.[9] Conditions associated with altered mental status in the geriatric trauma population and are listed in **Table 1**.

Review Data

Geriatric trauma patients frequently present with altered mental status. An understanding of potential etiologies of altered mental status is important to the ED diagnosis and management.

The issue of traumatic injury in the aging population was studied at the authors' institution through a retrospective chart review at the ED of Miami Valley Hospital, Dayton, Ohio, an urban hospital with an annual patient census of 95,000 visits.[10] This study was approved by the Wright State University Institutional Review Board (IRB) and the Miami Valley Hospital Human Investigation and Research Committee (HIRC).

The study included 1,077 geriatric trauma patients, 144 of whom had a Glasgow Coma Score (GCS) of 14 or lower (13.4%). Fifty-four percent of the patients were male. Most (88.19%) of the patients were white, 9.72 % were black, 0.69% were Hispanic, and 1.39% were of other ethnicities. The median patient age was 78.5±7.81 (SD). Forty-two percent of patients were transferred to Miami Valley Hospital from another institution. The mode of arrival and mechanism of injury are outlined in **Table 2**. The most common mode of arrival was ambulance (n = 101), followed by helicopter (n = 38), and walk-in (n = 5). Fall (n = 106) and motor vehicle collision (n = 26) were the most common mechanisms of injury. The most common comorbid medical conditions were hypertension (56%) and heart disease (49%; **Table 3**).

Laboratory Findings

Hyperglycemia (n = 121) was the most common laboratory abnormality seen in patients, followed by anemia (n = 71), sodium abnormalities (n = 13), and hypoglycemia (n = 4). The most common finding on brain computed tomography (CT) was subdural hemorrhage (n = 55; **Table 4**). The results of both alcohol and urine toxicology screens are outlined in **Table 5**. In this study, 82 patients were not tested for alcohol intoxication, and 109 patients did not have a urine toxicology screen. Of the patients tested for alcohol intoxication, 20% had an alcohol level greater than 80 mg/mL (legal limit for operating a motor vehicle in the state of Ohio). There was no significant association between alcohol level and age, gender (Fisher's exact test, P=.49), or ethnicity (Fisher's exact test, P=.08). Opiates were the most commonly found substance in patients tested via a urine toxicology screen.

Table 3. Comorbid Conditions Among 144 Geriatric Trauma Patients[10]

Comorbid Condition	Frequency in Sample	% of Sample
CNS/seizures, etc	39	27.08
Cardiac/MI/angina/cardiomyopathy/MVP, etc	71	49.31
Diabetes	39	27.08
GI/diverticulitis/hiatal hernia/reflux, etc	18	12.50
Hypertension	80	55.56
Malignancy (any type)	18	12.50
Pulmonary/asthma/COPD/bronchitis	24	16.67
Renal/renal failure/UTI, etc	14	9.72
Other	54	37.50

Abbreviations: CNS; central nervous system; COPD, chronic obstructive pulmonary disease; GI, gastrointestinal; MI, myocardial infarction; MVP, mitral valve prolapse; UTI, urinary tract infection.

Table 4. Computed Tomography Results of Geriatric Trauma Patients[10]

Computed Tomography Result	Frequency in Sample	% of Sample
Subarachnoid hemorrhage	44	30.56
Cerebrovascular accident	6	4.17
Epidural hemorrhage	6	4.17
Intraparenchymal hemorrhage	23	15.97
Subdural hemorrhage	55	38.19
Normal	53	36.81

Mortality

Although traumatic injury is a common presentation among geriatric emergency patients, this population is overall less likely to be involved in a traumatic event compared to other age groups. However, when injured, geriatric trauma patients are more likely to have fatal outcomes.

As previously noted, falls are the most common mechanism of injury in patients older than age 65 years. The trend of fall-related mortality increases with advanced age. It has been estimated that 36% of geriatric patients who fall will require a repeat ED visit or will die within 1 year following the fall.[11] Previous reports have demonstrated that mortality is associated with advanced age, injury severity score, shock index, transfusion, head injury, hypotension, and treatment site.[12-16]

Table 5. Alcohol Intoxication and Urine Toxicology Screen Among Geriatric Trauma Patients[10]

Variable	Result	N	%
Alcohol intoxication	No (ETOH ≤80)	49	34.27
	Yes (ETOH >80)	12	8.39
	Not tested	82	57.34
Urine toxicology screen	None detected	24	17.14
	Opiates	4	2.86
	Opiates/benzodiazepines	2	1.43
	Opiates/antidepressants	1	0.71
	Not tested	109	77.86

Abbreviation: ETOH, ethyl alcohol.

Cerebral Hemorrhage

In the study conducted at the authors' institution, most patients receiving a head CT scan had at least one abnormality.[10] Subdural hemorrhage was the most commonly reported abnormality followed by subarachnoid and intraparenchymal hemorrhages, respectively.[10]

Falls are a common cause of intracranial hemorrhage, and 30% to 40% of patients over age 65 years will experience at least one fall each year.[17] Consistent with these statistics, fall was the most common mechanism of injury in the patient population at the authors' institution. Intracranial hemorrhage can cause altered mental status by increasing the intracranial pressure and decreasing the cerebral perfusion pressure. These abnormalities are often amenable to medical and/or surgical treatment if identified in time.[18]

Hyperglycemia

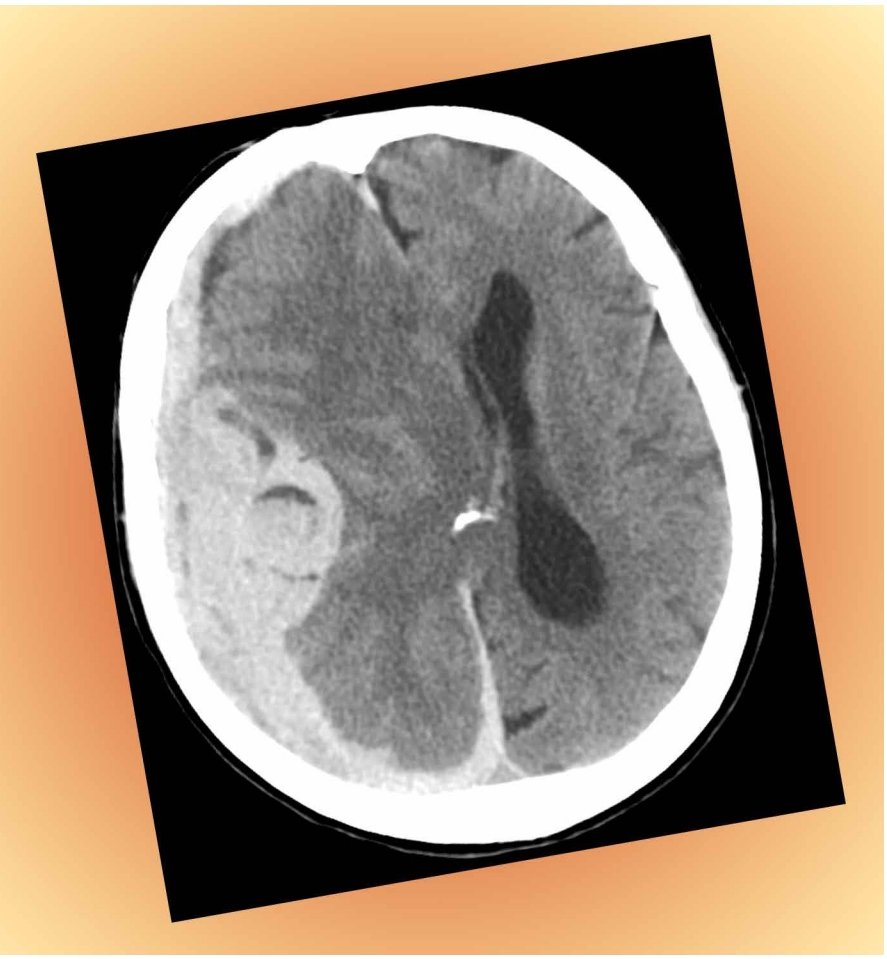
Hyperglycemia was one of the most common diagnostic test abnormalities associated with altered mental status in the authors' study.[10] Although increased blood glucose is part of the stress response to injury, geriatric patients experience a higher incidence of stress hyperglycemia and are unable to mount an adequate insulin response in trauma.[19,20] High-glucose levels are associated with significantly higher mortality rates among trauma patients.[21-24]

Alcohol Intoxication

Alcohol intoxication was common among the patients in the author's study.[10] In contrast, a smaller percentage of patients were tested and found to be positive for opioids or benzodiazepines. The risk of a traumatic brain injury (TBI) increases significantly if the patient sustained the injury while under the influence of alcohol.[25] Alcohol increases the mortality after trauma especially in patients over the age of 40.[26] Alcohol-related TBIs are associated with poorer outcomes with increasing age.[27] Falls at ground level after alcohol consumption are associated with more casualties than nonalcohol-related falls.[28,29]

Differential Diagnosis

As the case in this review illustrates, among geriatric trauma patients with altered mental status, the most common mechanism of injury is fall. The differential diagnosis should be considered, including intracranial hemorrhage, alcohol intoxication, nonprescription drug use, prescription-drug effects, infection, and/or metabolic or endocrine disorders. Appropriate laboratory and radiographic tests should be obtained, and may include CT of the brain



and cervical spine, chemistry profile, complete blood count, chest X-ray, urinalysis, alcohol level, and toxicology screen.

Conclusion

This case represents one of many common presentations of trauma among geriatric patients. There was evidence of multiple falls by chart review and physical examination. Evidence of multiple traumatic events of various stages should raise the suspicion of neurological deficits, substance or prescription-medication effects, or physical abuse of the elderly patient. The ED workup should include brain CT, electrolytes, complete blood count, chest radiograph, and urinalysis. The patient should be admitted for observation and workup for medical and traumatic etiologies of multiple falls. When discharged, home-health services or rehabilitation services should be considered.

The results of the authors' chart-review study confirmed that falls are the most common mechanism of injury in geriatric trauma patients presenting to the ED with altered mental status.[10] The most common diagnostic test abnormalities associated with altered mental status in this study included hyperglycemia, abnormal CT results, anemia, and alcohol intoxication. Future studies are needed to access relations between ethanol or opioid intoxication and the presence of positive CT findings to guide clinicians' judgment when ordering CT scans and other tests.

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