Chapter 7

Geriatric Trauma

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Additional information is available at the end of the chapter

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Abstract

Worldwide, the proportion of elderly people is constantly increasing. The aging of the baby boomers (people born between 1946 and 1964) and longer life spans (the maximum number of years that a human can live) result in a substantial increase in the number and proportion of older adults (whose age is ≥65). The older population is projected to more than double from 40.3 million in 2010 to 83.7 million in 2050 and, by 2050, it is estimated that older adults will represent 20.9% of the US population. In the early twentieth century, the average life expectancy at birth was 47.3 whereas it was 76.9 in 2000. With the increase in life expectancy due to improvement in quality of medical care, additionally, the oldest old age (age ≥ 85) forms a rapidly growing group within the older population. The rapid growth of these populations has many significant impacts on public health, emergency room visits, and economy.

Keywords: geriatric trauma, ATLS, trauma

1. Introduction and epidemiology

Worldwide, the number and proportion of elderly people is constantly increasing. The aging of the baby boomers (people born between 1946 and 1964) and longer life spans (the maximum number of years that a human can live) result in a substantial increase in the number and proportion of older adults (who is age ≥ 65).The elderly population is projected to reach to 83, 7 million in the year of 2050 and, by 2050, it is estimated that older adults will represent 20.9% of the U.S. population [1]. With the surge of the elderly population, there will be an increasing number of geriatric trauma patients admit to the emergency departments. Additionally, the rapid growth of these populations will have many significant impacts on public health and economy.

Geriatric trauma patients are less likely to be injured than younger people; however, they are more likely to have fatal outcomes. Death rates for Americans have decreased in the last century. Although there is a dramatic decline in deaths from cardiovascular diseseas, heart diseases remain the leading cause of deaths in the elderly. Also, trauma became the more common cause of death. According to the National Center for Health Statistics 2015 report, unintentional injuries became the seventh common cause of death in the elderly [2].

2. Pathophysiology

2.1. What is aging?

Aging is characterized by a progressive loss of physiological integrity, leading to impaired function and increased vulnerability to death [3]. This multifactorial and extremely complex process results in significant anatomic and functional changes in all major organ systems. Most important systems which are affected are seen in **Table 1**.

2.2. Age-related alterations and clinical consequences

Airway: The anatomy and physiology of the airway are affected with the aging process. Tooth decay which is common in elderly may cause loose, dislodged and subsequently aspiration of the teeth during emergency procedures such as endotracheal intubation (ET). Esthetic operations and loss of teeth interfere with achieving a good face-mask seal. Pharynx becomes more dry and fragile and care must be taken to prevent profuse bleeding while using laryngoscope. Oral cavity tumors and macroglossia may limit visualization of the vocal cords. Usage of Miller blade can be considered [4]. Also, cervical osteoarthritis increases the risk for spinal cord injury. Excessive movement of the neck should be avoided.

Age-related alterations: See **Table 1.**

2.3. Common mechanisms of injury

The common causes of geriatric trauma include falls, motor vehicle collisions, pedestrian injuries and thermal injuries and elder abuse (**Figure 1**).

Falls remain the leading cause of geriatric trauma and affect approximately 30% of persons aged ≥65 years each year [17]. Approximately 50% of people living in long-term care institutions fall each year, and 40% of them experienced recurrent falls [18]. Women experience significantly more fall-related injuries than men (35.7 vs.24.6%, respectively) [19]. Falls account for 40% of all injury-associated deaths [20]. Predisposing risk factors include age-related changes in muscle strength, gait and balance, poor vision and home hazards. İn addition, drugs and alcohol may contribute to falls. Anticoagulants usage are frequent in elderly and it may cause potentially lethal injuries even with minor traumas. Osteoporosis and the tendency to fall increase the risk of hip fractures. Also, falls are the most common cause of traumatic brain injury in the elderly. Even when those injuries are minor, they seriously affect older

Organ system	Age-related alterations	Clinical consequences
Respiratory system	Elastin component of the lung matrix ⬆	Risk for pneumonia⬆ [5]
	type III collagen ⬇ [5].	Poor tolerance to rib fractures
	Pulmonary compliance ⬇	Work of breathing ⬆
	Osteoporosis	Risk for respiratory failure ⬆ [8].
	Stiffness of the thoracic cage	Forced expiratory volume in one second (FEV1) ⬇
	Outward recoil ⬆	Forced vital capacity (FVC) ⬇
	Kyphosis [6].	FEV1/FVC ⬇[9].
	Chest wall compliance ⬇	Functional residual capacity (FRC) ⬇
	Thickening of the alveolar basement membrane [7].	Residual volume (RV) ⬆
	Diffusion capacity ⬇	Vital capacity (VC) ⬇
	Gas change ⬇	
	Muscle atrophy	
	Respiratory muscle weakness [8].	
Circulatory system	Vascular stiffness	Elevated baseline blood pressure
	Left ventricle (LV) wall thickness ⬆	Atherosclerosis of coronary vessel
	[10].	Risk for cardiac ischemia ⬆
	Retarded early diastolic cardiac filling and	Increased risk of dysrhythmias
	LV diastolic function ⬇	Impaired cardiac reserve
	Afterload ⬆	Cardiac index ⬇
	Left atrial size ⬆	Lack of classic response to hypovolemia
	myocyte mass with ⬇	
	deposition of amyloid and collagen	
	Deterioration of the cardiac conduction	
	Decreased sensitivity to catecholamines	
	Maximal heart rate ⬇	
	Maximum tachycardia response ⬇ [11].	

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Organ system	Age-related alterations	Clinical consequences
Musculoskeletal system	Stiffening of structural instruments (tendons, ligaments, cartilage)	Risk of injury ⬆
	Spontaneous rupture	Risk of fracture ⬆
	Joint stability ⬇	Difficulty for oral intubation
	ineffective repair of cartilage tissue	Risk of falls ⬆
	Osteoarthritis (cervical, temporomandibular)	Mobility ⬇
	Bone volume-mass ⬇	
	Muscle size-number ⬇ [12].	
	Osteoporosis	
	Sarcopenia	
Nutrition and metabolism	Taste acuity, smell and appetite decrease	Food intake ⬇ [13].
	Poor dentition	
	Inability to eat independently	
Central nervous system	Brain volume decreases	Less contusions
	Replaced by cerebrospinal fluid [14].	Clinical signs may manifest late
	Protection against contusions	More subdural hematoma
	Blood can be collected	Vision and auditory functions ⬇ [16].
	Parasagittal bridging veins stretch	Reaction time ⬆
	More prone to tear injury	Attention span ⬇
	Demyelination ⬆	Less epidural hematoma
	Peripheral conduction velocity slows	Risk for spine and spinal cord injury
	Dura adheres to the skull more tightly	
	Cerebral blood flow	
	Cerebral oxygen consumption [15].	
	Degeneration of vertebras, intervertebral disks and facet joints.	

Table 1. Age-related alterations and their clinical consequences.

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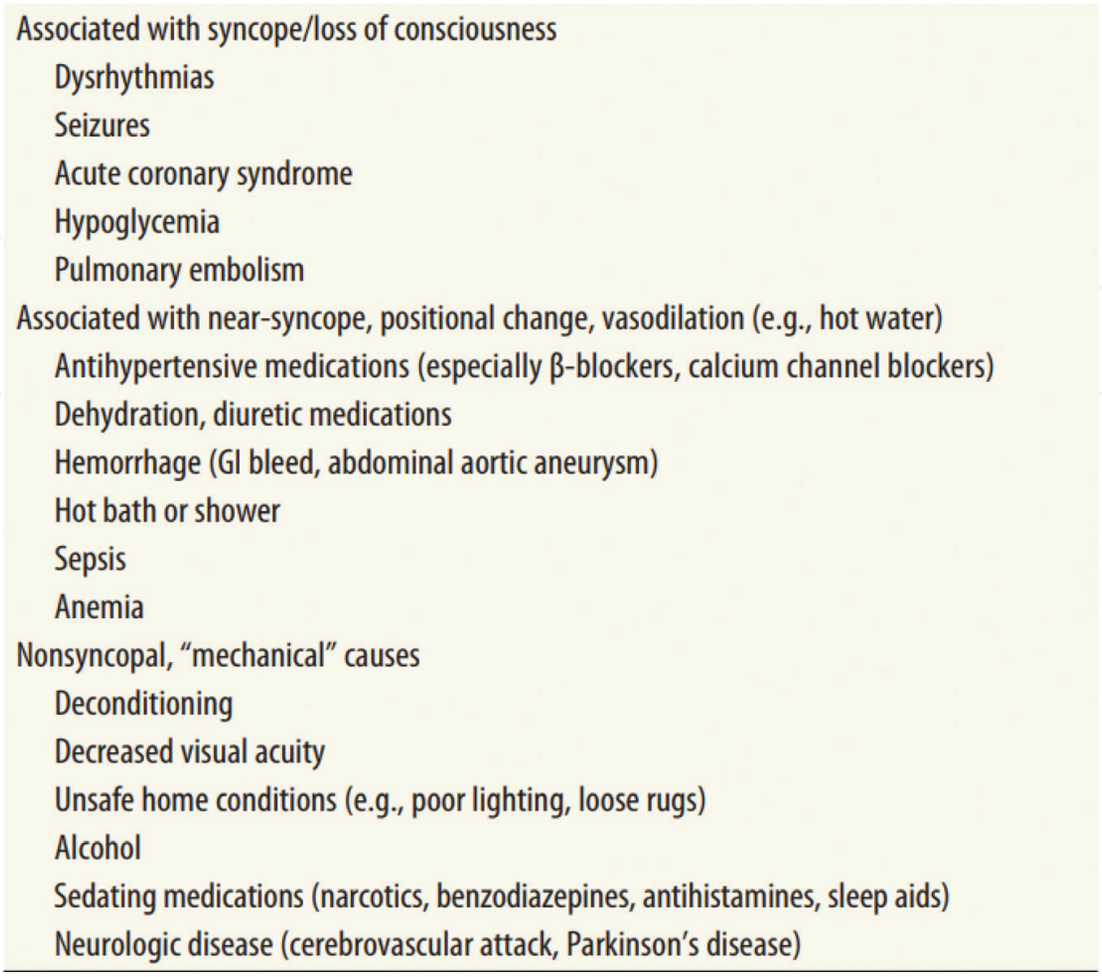

Figure 1. Common causes of falls in the elderly [64].

adults' quality of life by inducing a fear of falling, which can lead to self-imposed activity restrictions, anxiety, social withdraw and depression [21].

Motor vehicle collision involving elderly continue to increase. Age-related changes that include vision and hearing impairment, decreased night vision and glare resistance are the prominent factors on the incidence of injury and death. Additionally, medical conditions and medications may distort the reaction time, attention and judgment which increase the risk for the collision.

Pedestrian injuries: according to the 2015 pedestrian data, 19% of all pedestrian fatalities and an estimated 13% of all pedestrians injured were people aged 65 and older in the United States, and pedestrian-motor vehicle collisions are one of the most lethal mechanisms of injury in this age group with a 53% case fatality rate [22].

Thermal injuries: There is a direct relationship between age and burn mortality, as evidenced by the traditionally taught BauxScore. The empiric formula is clearly the simplest, whereby the sum of the patient's age and burn size predict mortality. Based on the data from the American Burn Association (ABA) National Burn Repository (NBR) from 2000 to 2009, overall

mortality was 4% in all age groups and 17% in seniors [23]. Moreover, for seniors there is a greater increase in mortality risk for every 1% increase in burn size and 1-year increase in age than among adults [23].

3. Clinical features and the management of injured elderly patients

The management of injured elderly requires the rapid assessment and rapid intervention of life-threatening situations. The assessment sequence should be same as in adults and pediatric population and includes the following elements:

3.1. Prehospital management and triage

The triage decision can be made through "field triage decision scheme" which was published by the American College of Surgeons Committee on Trauma (ACS-COT) to provide a guidance for the field triage process (**Figure 2**). Under triage, inaccurate triage which results in an assignment of lower triage level is more common among the elderly patients [24]. In order to avoid high under-triage rates in elderly, two important statements were added to Step Four of the scheme:

- SBP <110 might represent shock after age 65.
- Low impact mechanisms (e.g., ground-level falls) might result in severe injury.

Furthermore, we recommend that the injured elderly who met Step Four criteria should be transported to the trauma center [25]. Moreover, elderly seem to benefit more from triage to trauma center with improved outcomes [26]. Also, it is important that the transferring and receiving facilities develop transfer agreements in advance.

3.2. Primary survey

Primary survey of geriatric trauma patients includes rapid and efficient assessment of vital functions, assessment of the ABCDs, and identification and therapeutic intervention of life-threatening conditions as those for adults. Establishing and maintaining a patent airway to provide adequate oxygenation within-line cervical stabilization is the first objective. Avoiding excessive movement of the neck is crucial to prevent spinal cord injury. Because geriatric patients have limited respiratory reserve, early administration of supplemental oxygen is crucial. Early intubation should be considered if geriatric trauma patients present shock or chest wall injury/altered level of consciousness. For geriatric trauma patients, it is more challenging to recognize the early symptoms of shock. The aging process diminishes the physiologic reserve and chronic diseases can impair their ability to respond to injury; a tachycardic response may be absent or blunted. Also, medications such as β-blockers may mask tachycardia. Blood pressures are also misleading in the elderly patients. Due to increased incidence of underlying hypertension, the clinician must use a higher cutoff for hypotension than in younger patients [27]. In addition, frequently repeated measurement and interpreting the results according to baseline and previous ones may help the clinicians. Early and close monitoring must be instituted. Resuscitation of the elderly warrants special attention. Fluid

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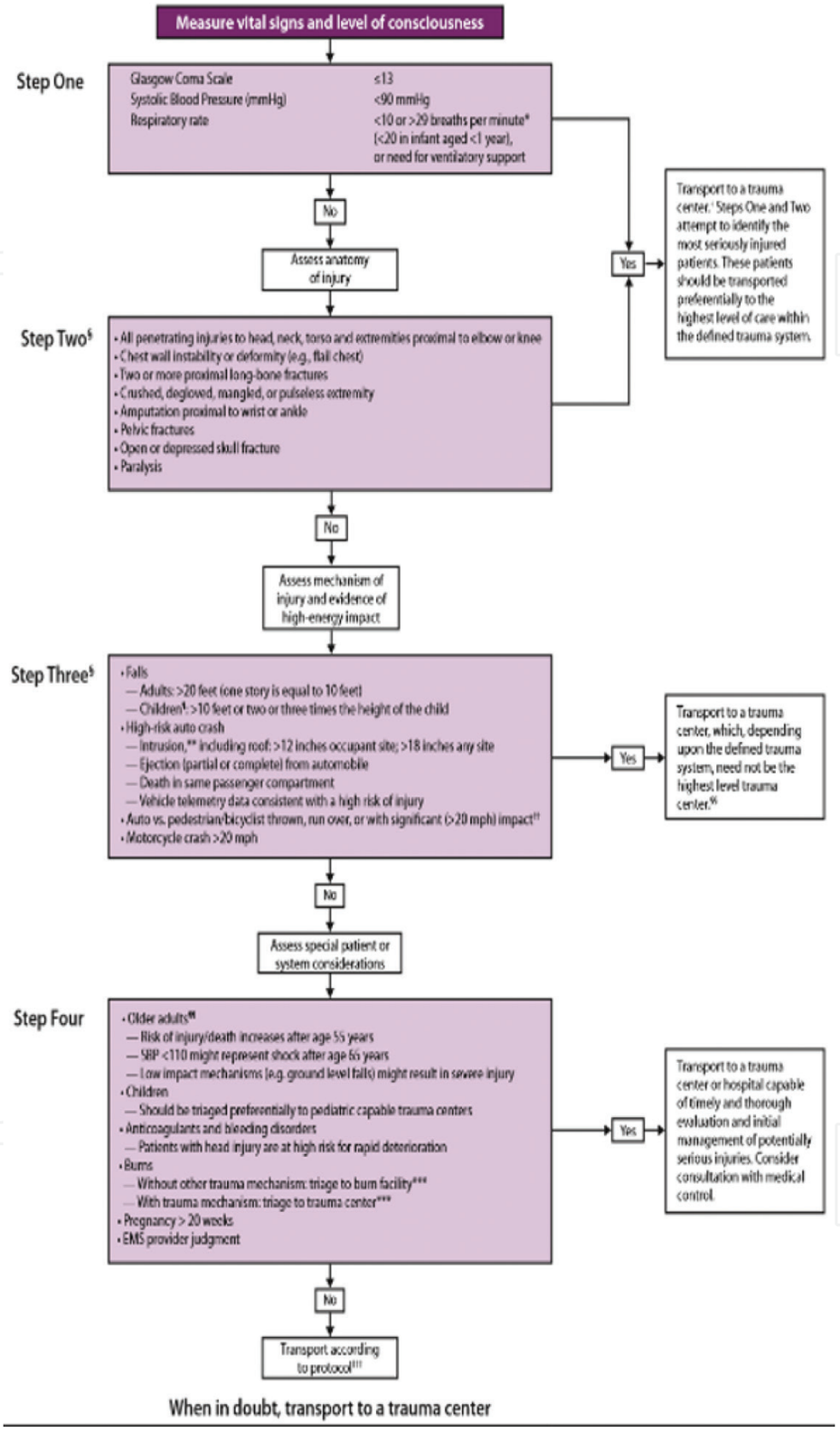

Figure 2. Guidelines for field triage of injured patients-United States, 2011 [65].

resuscitation is often challenging in geriatric trauma patients because of underlying cardiac dysfunction and concerns about precipitating heart failure. Primary survey also includes urinary and gastric catheters, arterial blood gas levels and X-rays (e.g., chest and pelvis). In the

elderly, due to alterations with aging, anticoagulant usage may increase the chance of profuse bleeding during the catheter procedure. Special care should be taken during this procedure.

3.3. Secondary survey

Secondary survey includes head-to-toe evaluation, reassessment of all vital signs, diagnostic tests and expanded history of the geriatric trauma patients. A detailed description of the secondary survey is provided separately; special circumstances in geriatric trauma patients are discussed here. Clinicians should focus on identifying and treating injuries which were not discovered during the primary survey. Geriatric trauma patients often present with significant occult injury mostly caused by minor mechanism such as ground-level falls. It is demonstrated that the elderly with blunt head trauma are more likely to present in occult fashion than youngsters, even if they have significant intracranial injury. Moreover, persistent vomiting and headache were less likely to occur in elderly with any intracranial injury [28]. Also, initially stable geriatric trauma patients may deteriorate rapidly and without warning. During the secondary survey it is essential to assess the alterations in mental status, especially compared to presentation.

3.4. High-risk injuries

The risk of complications increases with the severity of the *trauma*; however, even minor traumas such as ground-level falls or slipping while walking off a curb may seem relatively harmless in elderly patients, they can lead to severe injury and death [29].

3.5. Head injury

Traumatic brain injury (TBI) is a significant problem among the elderly. For the age of 65 years and older, falls are the primary mechanisms of TBI-related ED visits (81.8%) and TBI-related deaths (54.4%) [30]. In the review of the literature, it is recognized that older adults with moderate–severe TBI have poor outcomes with high rates of significant disability and mortality. Two major factors put geriatric trauma patients at a greater risk for increased incidence of TBI: age-related structural changes and preinjury anticoagulant-antiplatelet usage. First, with aging, parasagittal bridging veins stretch and make the elderly more susceptible to traumatic tears. Thus, the elderly have a higher incidence of subdural hematoma. Also, cerebral atrophy leads to a significant amount of blood accumulating in subdural area before clinical signs manifest. Rapid neurologic decline should be considered in these patients. Second, an increased incidence of the anticoagulant and antiplatelet therapy in the elderly may have detrimental consequences. It is suggested that taking anticoagulant therapy at the time of the injury increases the risk of intracranial hemorrhage [31] and is related with worse outcomes [32, 33]. One of the most frequently prescribed anticoagulant medications is warfarin. Also, Franko et al. concluded that warfarin use at the time of injury also makes mortality significantly higher after the age 70 [32]. Thus, immediate noncontrast head computed tomography (CT) is recommended for the elderly patients who take anticoagulant or antiplatelet therapy, even if their trauma seems minor. Additionally, rapid screening for anticoagulant use, INR value and subsequent correction with blood component therapy may improve outcomes.

3.6. Spine injury

Cervical spine injuries are more common in the elderly and the incidence appears to be increasing [34, 35]. The most commonly seen injury site is upper cervical spine (UCS) especially the odontoid process [36] and caused by falls. The UCS injuries are associated with a high rate of mortality and morbidity. Elderly patients tend to sustain more C-spine fracture following simple falls such as ground-level falls [37]. It is attributed to increased frequency of preexisting cervical spine pathology such as osteoporosis and osteoarthritis [36]. It may also result in occult presentation, delayed diagnosis, increased risk for spinal cord injuries and difficulty in interpreting plain radiographs. Moreover, mild extension injuries followed by fall or rear-end motor vehicle crushes may cause central cord syndrome in the presence of preexisting spinal canal stenosis [37].

Thoracolumbar spine fractures in the elderly are usually associated with osteoporosis. Osteoporosis affects almost 50% of these individuals and contributes to the occurrence of spontaneous vertebral compression fractures. The majority of the osteoporotic vertebral fractures are situated in thoracolumbar spine, and the anterior wedge compression fractures are the most common site.

Treatment of diagnosed vertebral fractures in these individuals is still controversial. Two options are avaliable: conservative therapy and surgery. Unstable fractures, flexion distraction injuries and severe burst fractures causing neurologic deficit mostly indicate surgical intervention. However, in the patient who is neurologically intact, conservative treatment including bad-rest and bracing seems a more viable option depending on the type of fracture [38]. Consequently, we recommended that apparently low-energy level injuries should be considered as a high-risk for spine injury and investigated elaborately. CT scan is the preferred initial modality for assessing the geriatric cervical spine because The Canadian Cervical-Spine Rule, but not the National Emergency X-Radiography Utilization Study criteria, excludes patients aged ≥65 years from being considered low risk for cervical spine injury.

3.7. Chest trauma

Chest traumas account for ~796,000 emergency department (ED) visits annually in the USA [39]. For blunt chest trauma, the most prominent factors in etiology are falls and motor vehicle collisions. The elderly are more prone to incur chest injuries following blunt chest trauma, and this is associated with a high risk of mortality and morbidity [40]. Rib fractures and pulmonary contusions are more common in this population due to preexisting osteoporosis, loss of muscle mass and comorbidities [41]. The mortality and risk for pneumonia following blunt chest trauma significantly increase after 65 years [40, 41] and it is correlated with the increased number of rib fractures [40, 42]. In the presence of pulmonary contusion, clinicians should consider early ventilatory support because these patients are highly vulnerable to respiratory compromise. Given these risks, detailed physical examination, close observation and early administration of supplemental oxygen with adequate pain medication are highly recommended for elderly patients with even one rib fracture. Also, advanced imaging is warranted in older patients with multiple rib fractures. CT may be necessary to assess the extent of

injuries that might not be seen on plain radiographs. Simple pneumothorax and hemothorax are poorly tolerated by elderly patients. Thus, geriatric patients with life-threatening chest trauma should be considered for intensive care unit (ICU) observation.

3.8. Abdominal trauma

Abdominal examination can be less reliable and more difficult because of decreased pain sensation and increased laxity of abdominal wall musculature. Also, guarding and rigidity may be lacking in the elderly. Tachycardia response to hemorrhagic shock may not be seen even in the setting of significant blood loss. High index of suspicion and close observation must be continued to be avoided under-diagnosis. The Focused Assessment with Sonography for Trauma (FAST) can be used to detect intraperitoneal fluid in patients who sustain blunt abdominal trauma. CT remains the gold standard to diagnose intra-abdominal injuries. Retroperitoneum is an occult source of bleeding. Also, the risk of occult retroperitoneal bleeding is higher with chronic anticoagulant usage. Therefore, CT with contrast should be considered to evaluate hemorrhage, especially for the elderly patients who have pelvis or hip fracture.

3.9. Musculoskeletal trauma

Fractures are frequent in the elderly and can cause severe pain, disability and loss of independence. The increased risk of fracture with age may attribute to increased risk of fall, osteoporosis, sarcopenia and frailty.

Pelvis fractures: In the elderly, low-energy traumas such as ground level falls may result in pelvic fractures [43]. Although patients with pelvic fractures due to minor trauma generally do not present complications, mortality and morbidity increase with accompanied hemorrhage and other associated injuries. The portable AP pelvic X-ray should be obtained as a part of the primary survey. However, posterior ring fractures can be missed. Patients who have pelvic tenderness following pelvic trauma must be assessed regarding pelvic fracture. CT of the pelvis can be obtained in stable patients. If an active bleeding is suspected, pelvic contrast CT is recommended considering the risk of contrast-induced nephropathy. If an active bleeding is identified, arteriography and embolization can be performed for the patients in danger of life. Consequently, expeditious hemorrhage control with simultaneous emergency skeletal stabilization and resuscitation is crucial for the management of pelvic fractures in the elderly.

Proximal femur fractures: In elderly patients, hip fractures should be considered as a serious injury. They may lead to immobility, permanent dependence and death. According to several epidemiological studies, the incidence of proximal femoral fractures increases with age, starting at 40 years, with a steep increase after 75 years of age. The average age of patients with hip fracture is over 80, and nearly 80% are women [44]. Although isolated hip fractures do not usually cause class III or class IV shock, long-term prognosis mostly depends on age, comorbidities, anticoagulant therapy and frailty [45]. Hip fractures are the most common cause of accident-related deaths in older people accounting for 18% deaths within 4 months of a hip fracture and 30% within a year [46]. The risk of fracture increases with the number of falls [47] and backward fall mechanism and low bone mineral density (BMD) [48]. Most hip fractures can be diagnosed by typical history and clinical presentations. The first choice

for diagnose is plain radiographs. However, it is estimated that 2–9% of fractures may be radiographically occult [49], and further imaging such as CT and MRI is required to make a definitive diagnosis. MRI has higher sensitivity than CT for detecting occult hip fractures. Additionally, nuclear medicine scintigraphy may be another choice for diagnosis due to high sensitivity. However, access to the scintigraphy usually is difficult and, it has limited capability to delineate the full nature of the fracture.

4. Special circumstances

4.1. Preexisting medical conditions

Elderly individuals are more likely to have preexisting comorbidities. The presence of a preexisting medical condition was associated with increase in mortality of elderly patients who sustained low or moderate severity trauma [50]. The most frequent preinjury comorbidities are hypertension (HT), diabetes mellitus (DM), coronary artery disease (CAD) and use of anticoagulants/antiplatelets [51]. Preinjury medical conditions usually make the management of geriatric trauma patients challenging; preexisting HT can hide the early signs of shock and cause delay or under-treatment and the presence of heart failure may cause volume overload and pulmonary edema during IV fluid therapy. ET intubation also would be challenging in the patient who has cervical or temporomandibular arthritis. Thus, early detection of preexisting medical conditions, appropriate treatment and follow-up care may improve outcomes following trauma in elderly.

4.2. Pre-injury medication usage

As the population ages, increasing numbers of elderly are being prescribed a medication for chronic medical conditions. It was shown that medications (especially sedatives and hypnotics, antidepressants, and benzodiazepines [52]) are particularly complex risk factors for falls and the risk of falling increases with the number of medications taken [18]. Also, polypharmacy is associated with occurrence of drug–drug interactions and adverse drug reactions which are frequently encountered in the elderly [53]. B-adrenergic blocking agents may limit the tachycardia response which can result in undesirable decreased cardiac output and reduced tissue perfusion. Calcium-channel blockers may prevent peripheral vasoconstriction and contribute to produce hypotension. Chronic diuretic use may lead to elderly patients being chronically hypovolemic, hyponatremic and hypokalemic. Additionally, declines in renal and hepatic function may alter the metabolism and clearance of these drugs. The side effects, drug interactions should always be considered and potentially nephrotoxic drugs must be given in adjusted doses based on calculated creatinine clearance.

4.3. Risk of bleeding

In the elderly population, both age-related structural changes and usage of some chronic medications may increase the risk of bleeding. Chronic anticoagulant therapy can increase the risk of hemorrhage, especially intracranial hemorrhage (ICH) [31]. The usage of warfarin at the time of injury also makes mortality significantly higher after the age 70 [32]. Recent

data show that Apixaban, dabigatran and rivaroxaban have lower risk of intracranial bleeding compared to warfarin [54]. However, they may potentially carry more risk of major bleeding than warfarin [55]. The influence of preinjury aspirin therapy on bleeding and the mortality is still uncertain [56]. However, the increased risk of subdural hematoma following head trauma was shown in the patients who are under preinjury aspirin plus clopidogrel therapy [57]. Hemorrhage cannot be tolerated appropriately. Therefore, the management of elderly trauma patients who are under anticoagulant therapy requires special care. Early diagnosis, close monitoring and maintaining optimal hemoglobin level are crucial. The optimal hemoglobin level for injured elderly patients is still controversial. A general suggestion is that hemoglobin concentration should be maintained over 10 g/Dl in order to maximize oxygen carrying capacity and delivery. Also, correction of coagulation defects is very important. According to the Eastern Association for the Surgery Trauma, all elderly patients with evidence of posttraumatic ICH on CT with Warfarin should have their INR be corrected toward a normal range within 2 h of admission [58]. Moreover, tranexamic acid, an antifibrinolytic agent, may reduce blood loss after traumatic injury. According to the recent data, tranexamic acid may reduce mortality without significant adverse side effects when given within 1–3 h [59]. The dose is 1 g of tranexamic acid IV bolus over 10 min, followed by 1 g IV over 8 h.

Pain management altered physiology changes the way analgesic drugs are distributed and metabolized therefore the pain management of geriatric trauma patient requires extra caution. The main approach should provide optimal treatment of pain while minimizing the risk of medication-related adverse effects. The standardized tools to assess the pain may be beneficial [60] (**Table 2**).

Pain type or source	Nonopioids	Opioids	Adjuvant analgesics	Other	Comments
Major trauma generalized pain	Acetaminophen, NSAIDs during posttrauma healing phase	Bolus or continuous IV opioids* during emergency phase; PO or IV opioids during healing phase	IV ketamine (very rare)	Inhaled NO	Use of ketamine is restricted to pain refractory to other treatments due to severe CNS side effects Inhaled NO is used for incident pain
Major trauma (regionalized pain)	NSAIDs (parenteral, oral) during posttrauma healing phase	Bolus or continuous IV opioids during emergency phase plus regional anesthesia	IV ketamine (very rare)	Inhaled NO	Use of ketamine is restricted to pain refractory to other treatments due to severe CNS side effects. Inhaled NO is used for incident pain

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Pain type or source	Nonopioids	Opioids	Adjuvant analgesics	Other	Comments
Burns	Acetaminophen, NSAIDs, during rehabilitative phase	High dose of IV opioids ± PCA for NPO patients; oral opioids (e.g., morphine, hydromorphone) when taking PO	Parenteral ketamine (very rare) IV lidocaine (very rare)	BNZ Inhaled NO	Use of ketamine is restricted to pain refractory to other treatments due to severe CNS side effects. Inhaled NO is used for incident pain Infusion of low-dose lidocaine is restricted to burn pain refractory to opioids.
Minor trauma	Acetaminophen, NSAIDs	Opioids for mild-to-moderate pain			
Procedural pain	NSAIDs for preemptive analgesia and postprocedural pain	IV opioids (e.g., morphine, hydromorphone, fentanyl) unless contraindicated**	Local anesthetics (e.g., EMLA®, lidocaine, bupivacaine, ropivacaine) IV ketamine	BNZ (e.g., diazepam, lorazepam, midazolam) Inhaled NO Propofol***	Local anesthetics may be applied topically (e.g., EMLA®), injected into tissue, or used for nerve blocks Use of ketamine limited by severe CNS side effects

BNZ: benzodiazepines; CNS: central nervous system; EMLA®: Eutectic Mixture of Local Anesthetics (lidocaine and prilocaine); IV: intravenous; LAs: local anesthetics; NO: nitrous oxide; NPO: nothing per os (by mouth); NSAIDs: nonsteroidal anti-inflammatory drugs, including aspirin: PO: per os (oral); PCA: patient-controlled analgesia; PRN: as needed; TD: transdermal.

Modified from American Pain Society, Section IV: Management of Acute Pain and Chronic Noncancer Pain. http://americanpainsociety.org/uploads/education/section_4.pdf.

*Titrate opioids carefully to maintain stable cardiovascular and respiratory status. Monitor neurological and neurovascular status continuously in patients with head injury or limb injury, respectively.

**Contraindications to opioid analgesia include altered sensorium, full-term pregnancy, lung disease or inability to monitor and manage certain side effects (e.g., respiratory depression).

***Hypnotic general anesthetic that produces good sedation.

Table 2. Systemic medications for acute pain management.

The search of literature mostly suggests that paracetamol should be considered as a first-line treatment for both acute and chronic pain due to its efficacy and good safety profile. NSAIDs are one of the most widely used painkillers. Clinicians must be concerned about the

Type of Abuse	Clinical Markers Indicating Abuse or Neglect
Physical abuse	Abrasion and laceration in sites other than the arms and legs or multiple ones should raise suspicion. Bruising on face, neck, the chest wall, the abdomen, the buttocks, the palms and soles. Tramline bruising. Fractured, subluxed, or avulsed teeth Fractures of the zygomatic arc, mandible and maxilla Fractures not involving the hip, humerus, or vertebra A spiral fracture of a large bone with no history of gross injury or atypical site
Verbal or psychological abuse	Subtle signs of intimidation, such as deferring questions to a caregiver or potential abuser Evidence of isolation of victim from both previously trusted friends and family members
Sexual abuse	The majority of victims have cognitive impairment or have functional limitations. Bruising of the uvula and the palate may indicate forced oral copulation Bleeding, abrasions, lacerations in the anogenital area as well as difficulty in sitting New diagnosis of sexually transmitted diseases, especially in nursing home residents (and especially in cluster outbreaks)
Financial exploitation	Inability to pay for medicine, medical care, food, rent, or other necessities Failure to renew prescriptions or keep medical appointments Unexplained worsening of chronic medical problems that were previously controlled Malnutrition, weight loss, or both, without an obvious medical Firing of home care or other service providers by abuser Unpaid utility bills leading to loss of service
Neglect	Deep decubitus ulcers in multiple sites or foul-smelling, and necrotic ulcer may indicate neglect Refusal to eat may indicate improper feeding technics such as forceful assistance may lead to choking, aspiration and pneumonia. Need help with eating? Adverse side effects due to improper dosing of an indicated drug Overdosing patients to keep them quite and manageable Recent decline in personal care, dirty clothes, multiple insect bites are the signs of poor hygiene.

Table 3. Clinical markers indicating abuse or neglect [66, 67].

potentially life-threatening side effects such as gastrointestinal hemorrhage. And, it must be given with proton-pump inhibitor (PPI) cover. In carefully selected and monitored patients, opioids usually provide fast and effective pain relief. The weak opioids including co-codamol, codeine and dihydrocodeine may elicit adverse effects such as cognitional decline and constipation. Although tramadol's GI effects lesser than other weak opioids, potential to precipitate delirium and reduced seizure threshold may limit the usage [61]. Strong opioids include morphine, oxycodone and fentanyl may also be used to treat moderate and severe pain, especially if the pain causes functional impairment. Dose titration based on patient's response is required, in order to avoid side effects such as sedation, nausea or vomiting.

4.4. Elder abuse/maltreatment

Elder abuse is a global public health and human rights problem which is associated with morbidity and premature mortality. According to the latest data, the prevalence of elder abuse can vary widely. In USA, 10% of older adults have experienced some form of elder abuse [62].

Unfortunately, these statistics may represent an inaccurate underestimation because elder abuse often is not recognized and tends to be underreported. Elder abuse can be classified into five main categories and manifestations is shown in **Table 3**, but several types of abuse may occur simultaneously.

The risk factors can be stated as: shared living situation, social isolation, dementia, female gender, relationship of victim to perpetrator (spouse), personality characteristics of victim (hostility), race (black) [63].

Also it is crucial to screen for elder abuse in geriatric trauma patients, especially who have cognitive impairment or who are unwilling to report it due to fear. Health professionals are well positioned to identify elder abuse, detect vulnerabilities and evaluate interventions. If abuse or neglect is suspected or confirmed, management strategies should be applied.

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