Geriatric Considerations in Common Surgical Conditions

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12.1 Introduction

It is estimated that by the year 2030, about 20% of Americans will be older than 65, while one out of four elderly individuals will be older than 85 years of age. Twenty-one percent of those over age 60 will undergo surgery and anesthesia as compared with only 12% of those aged 45 to 60 years. Despite the higher numbers of elderly patients having surgery, mortality and morbidity rates have been declining. Older age appears to have assumed less influence as a determinant of adverse outcomes, as perioperative care has improved. A better understanding of the associated risk factors leading to perioperative complications may help providers to further lower the risk and is discussed in more detail in ▶ Chap. 10—Geriatric Preoperative Evaluation of the Older Adult. This chapter will describe some of the most common surgeries completed in older adults.

12.2 Breast Cancer

With the aging population in the United States, there has been an increase in the prevalence of breast cancer in the geriatric population. In fact, following skin cancer, it is the most common cancer and second most common cause of cancer-related deaths. Risk factors for the development of breast cancer are well established and are attributed to almost half of the reported cases. A much smaller percentage of breast cancers can be attributed to genetic mutations, such as BRCA1 and BRCA2.

12.2.1 Surgical Considerations

Currently, the main surgical treatment options for breast cancer include the modified radical mastectomy (MRM) and breast-conserving therapy (BCT). Which type of surgery is appropriate to recommend for the patient is dependent both on the stage of cancer and patient preference. For cancers that are not amenable to breast-conserving therapy (i.e., T3 tumors or multifocal tumors), a modified radical mastectomy is indicated. The modified radical mastectomy involves removal of the breast, including the pectoralis fascia. Multiple studies have shown that a patient's age should not preclude the surgeon from offering the MRM when appropriate, as operative mortalities have been reported to be between 0.2% and 4.5% [1].

In the early stages of breast cancer, BCT is considered to be an appropriate treatment in patients of all ages, with strong evidence to support that BCT is as effective in creating a disease-free state as MRM in the appropriate patient population. Contraindications to BCT can be found in ▶ Box 12.1. BCT in the elderly provides a better quality of life, and several studies have shown that at 10 years follow-up, there is a lower rate of recurrence in those >55 years old [1]. It is important to note that patients who undergo BCT with postoperative radiation will have a significant reduction in local recurrence at 5 and 15 years [1]. In the geriatric population, postoperative radiation is well tolerated and is in fact better tolerated in those >65 years of age than those in the younger populations.

Previously, the standard of care for patients with sentinel node-positive breast cancer was that they required an axillary lymph node dissection (ALND), which is the excision of all of the level I and level II axillary lymph nodes. However, in 2010, the ACS Oncology Group published their randomized trial, the Z11 trial, which analyzed the safety of performing solely a sentinel lymph node biopsy (SLNB) for patients with T1 or T2 N0 M0 breast cancer undergoing breast-conserving therapy [2]. They concluded that there was no significant difference in 5-year recurrence rates between the two groups [2].

Box 12.1 Contraindications to Breast-Conserving Therapy

1. 2+ primary tumors in different breast quadrants
2. Diffuse malignant-appearing microcalcifications
3. Prior therapeutic irradiation
4. Positive margins despite multiple attempts at BCT

12.2.2 Hormone Therapy

The benefit of the use of hormone therapy is determined by the ER and PR hormone receptor status of the cancer. In the postmenopausal state, in ER/PR-positive patients, current guidelines recommend the use of an aromatase inhibitor along with a selective estrogen receptor modulator, such as anastrozole or tamoxifen, respectively, with the addition of trastuzumab in HER-2 positive disease [3].

12.2.3 OncotypeDx

While ER/PR/HER-2 positivity helps determine the use of hormone therapy, the OncotypeDx genomic assay is now being used to determine whether the addition of systemic chemotherapy will significantly affect a patient's 5-year risk of recurrence [4]. This gene assay is applied to those with early-stage ER+, node-negative cancers. A patient receives a score between 0 and 100 and, from this result, can be placed into low-, intermediate-, and high-risk groups of recurrence. A score <10 has been shown to have a 5-year disease-free survival of 93.8% and an overall survival of 98% with adjuvant endocrine therapy alone, without the use of systemic chemotherapy [5]. Studies have shown that those in the high-risk group (recurrence score >25) would benefit the most from systemic chemotherapy. Further studies are needed at this time to determine the benefit of systemic chemotherapy in addition to hormonal therapy in those with scores of 11–25.

12.2.4 Breast Cancer Staging

Traditionally, breast cancer staging was based on anatomic characteristics of the primary tumor, using the TNM system, similar to other cancer staging systems. However, in 2018, the American Joint Committee for Cancer (AJCC) has incorporated the use of tumor genetics into its staging system for breast

cancers [6]. A tumor's genetics, including ER/PR/HER-2 positivity, has played an important role in determining a patient's treatment plan, as described above. However, a tumor's genetics have not yet been used in classifying patients into prognostic stage groups and help determine which patients better benefit from systemic chemotherapy. With the new staging system, a patient's prognosis is determined not just by tumor size, presence of positive nodes, and distant metastasis. The new AJCC guidelines now incorporate ER/PR/HER-2 positivity, as well as OncotypeDx® scores into the staging system.

12.3 Prostate Cancer

Prostate cancer is the second leading cause of death from cancer in men, the most significant risk factor being age [7]. Most patients with prostate cancer are asymptomatic, and the presence of symptoms suggests advanced disease at presentation. According to the National Comprehensive Cancer Network recommendations, there is no current recommendation age for when to start and stop screening; however, there are several recommendations for screening methods and time intervals. In patients who elect to partake in an early detection program, the recommendation is for baseline PSA (prostate-specific antigen) levels as well as a baseline digital rectal examination. However, the use of PSA levels is controversial. In fact, the US Preventive Services Task Force recommends against the routine use of obtaining PSA levels as a screening method for prostate cancer. These recommendations are based on the fact that multiple studies have not showed a reduction in overall mortality in patients who were routinely screened for prostate cancer [8].

12.3.1 Staging

The American Joint Cancer Committee has defined a TNM staging system as seen in Table 12.1 [9].

12.3.2 Biopsy

Transrectal ultrasound is a minimally invasive method used to detect prostate cancer [7]. A biopsy needle is used to take multiple biopsies of the prostate, which has shown improved cancer detection as well as the ability to provide information on the staging of cancer.

12.3.3 Surgical Considerations

A radical prostatectomy is the surgical treatment of choice for prostate cancer and can be performed through open techniques, either through a lower midline incision or perineal

Table 12.1 Prostate cancer TNM classification

TX	Primary tumor cannot be assessed		NX	Regional lymph nodes not assessed	MX	Distant metastasis cannot be assessed	
T0	No evidence of primary tumor		N0	No regional lymph node metastasis	M0	No distant metastasis	
T1	Clinically unapparent tumor neither palpable nor visible by imaging		N1	Metastasis in regional lymph nodes	M1	Distant metastasis	
	1a	Histologic finding <5% of tissue				1a	Non-regional lymph nodes
	1b	Histologic finding >5% of tissue				1b	Bones
	1c	Tumor identified by needle biopsy				1c	Other site with or without bone disease
T2	Tumor confined within prostate						
T3	Tumor extends through prostate capsule						
T4	Tumor is fixed or invades adjacent structures other than seminal vesicles						
Staging							
I	T1a		N0		M0		
II	T1–2		N0		M0		
III	T3		N0		M0		
IV	T4		N0		M0		
	Any T		N1		M0		
	Any T		Any N		M1		

incision [7]. Advances in technology have allowed for this procedure to be now predominantly performed laparoscopically and robotically.

12.4 Upper Gastrointestinal Disorders

12.4.1 Esophageal Cancer

Esophageal cancer is prevalent both in the United States and worldwide, with squamous cell carcinoma being more common worldwide and adenocarcinoma being more common in the United States [9]. These types of cancers typically manifest late and in the elderly population, with a 5-year survival of 15–25% [10].

Esophageal adenocarcinoma arises from Barrett's esophagus in the setting of gastroesophageal reflux disease (GERD); however, smoking and obesity are also strong risk factors for the development of adenocarcinoma [9]. Chronic GERD can lead to metaplastic changes, so endoscopic biopsies should be taken to evaluate for these changes that may degenerate into cancer. While there are no set guidelines for screening for esophageal cancer, several studies have recommended that patients with dysphagia and chronic GERD symptoms should be screened [9–11]. Once the diagnosis of esophageal cancer has been made, there are several treatment options, whose indications will depend on the stage of the cancer on discovery. Complete staging should be performed with endoscopic ultrasound to determine the depth of invasion and local nodal involvement, and PET/CT should be added for larger lesions to evaluate for metastatic lesions [9]. Therapeutic options can range from endoscopic ablation to esophagectomy, which will depend on the stage of the lesion [9].

12.4.2 Peptic Ulcer Disease

Peptic ulcer disease originates from mucosal damage that leads to ulceration of the stomach lining and is most commonly caused by *H. pylori* infection and NSAID use [12]. *H. pylori* has also been found to be the most common cause of gastritis, as well as for mucosa-associated lymphoid tissue (MALT) lymphoma [12].

Upper endoscopy can be used to visually diagnose peptic ulcer disease, while also having the advantage of the ability to take tissue samples to biopsy for *H. pylori*, as well as cancer [12]. However, endoscopic biopsies are not required to identify *H. pylori*. Less invasive methods include an immunoassay looking for IgG antibodies, a urea breath test, and stool antigen studies. It is important to be aware that the sensitivity is affected by the recent use of proton pump inhibitors, so these medications should be held for 2 weeks prior to test administration [12].

Once the diagnosis of peptic ulcer disease is made, treatment is directed at decreasing the acidic environment of the stomach, improving the mucosal barrier, and eradication of *H. pylori*, as well as avoidance of medications that lead to gastritis such as NSAIDs. The use of antacids, H2 receptor blockers, and PPIs can help decrease the acidic environment of the stomach. Sucralfate is a therapeutic option that likely helps with improving the mucosal barrier of the stomach, allowing for a layer of protection to the stomach lining against the acidic environment of the stomach [11]. In peptic ulcer disease caused by *H. pylori*, treatment is directed at the eradication of the bacteria and acid suppression [12]. Triple therapy for the eradication of *H. pylori* includes the use of PPI, amoxicillin and clarithromycin, or metronidazole in the penicillin-allergic patients for 2 weeks. In those whose treatment fails with triple therapy, quadruple therapy is initiated by the addition of bismuth.

12.4.3 MALT Lymphoma

MALT lymphoma is a type of lymphoma that involves mucosa-associated lymphoid tissue, usually originating from the stomach. Since MALT lymphoma is strongly associated with *H. pylori* infections, treatment is directed toward the eradication of the bacteria as described above [12]. Treatment usually leads to complete remission of MALT lymphoma, however, follow-up endoscopy 2 months after completion of therapy is necessary to evaluate and confirm response to treatment [12].

12.4.4 Gastric Cancer

Gastric cancer is a common cause of cancer and cancer death in the United States, with a peak incidence in the elderly population in the seventh decade of life [12]. There are multiple environmental and genetic risk factors to take into consideration when suspecting gastric cancer, which can be seen in Table 12.2.

Table 12.2 Risk factors for gastric cancer

Nutritional	Environmental	Social	Medical	Others
Low fat/protein	Poor food preparation	Low socioeconomic class	Prior gastric surgery	Male gender
Salted meat/fish	Lack of refrigeration		*H. pylori* infection	
High nitrates	Poor drinking water		Gastric atrophy and gastritis	
High complex carbohydrates	Smoking		Adenomatous polyps	

Symptoms of gastric cancer are usually nonspecific but may include epigastric pain not relieved with eating, early satiety, and weight loss [12]. Diagnosis is made with endoscopy and endoscopic ultrasound, and can be both diagnostic and therapeutic, by allowing for biopsies, and in the case of obstructing or bleeding lesions, stent placement and hemostasis can be achieved. Once the diagnosis of gastric cancer is made, staging should be completed, and treatment should be tailored based on completion (Table 12.3) [13]. Endoscopic ultrasound is used to determine the depth of tumor invasion

Table 12.3 Gastric cancer TNM classification [13]

Tx	Primary tumor cannot be assessed		NX	Regional lymph nodes cannot be assessed		M0	No distant metastasis
T0	No evidence of primary tumor		N0	No regional lymph node metastasis		M1	Distant metastasis
Tis	Carcinoma in situ		N1	Metastasis in 1–2 regional lymph nodes			
T1	Tumor invades lamina propria, muscularis mucosa, or submucosa		N2	Metastasis in 3–6 regional lymph nodes			
	1a	Invades lamina propria/muscularis mucosa	N3	Metastasis in >7 lymph nodes			
	1b	Invades submucosa					
T2	Invades muscularis propria			3a	Metastasis in 7–15 lymph nodes		
				3b	Metastasis in >16 lymph nodes		
T3	Penetrates subserosal tissue, no invasion of viscera						
T4	Invades serosa or adjacent structures						
	4a	Invades serosa					
	4b	Invades adjacent structures					

Staging			
0	Tis	N0	M0
1A	T1	N1	M0
1B	T2	N0	M0
	T1	N1	M0
IIA	T3	N0	M0
	T2	N1	M0
	T1	N2	M0
IIB	T4a	N0	M0
	T3	N1	M0
	T2	N2	M0
	T1	N3	M0
IIIA	T4a	N1	M0
	T3	N2	M0
	T2	N3	M0
IIIB	T4b	N0–N1	M0
	T4a	N2	M0
	T3	N3	M0
IIIC	T4b	N2	M0
	T4b	N3	M0
	T4b	N3	M0
IV	Any T	Any N	M1

and regional nodal involvement. The addition of a CT of the chest, abdomen, and pelvis will complete the staging of gastric cancer in order to assess for distant disease. Once the staging is completed, surgical therapy is determined based on final staging as well as the location of the primary cancer on the stomach. According to the National Comprehensive Cancer Network recommendations, neoadjuvant and adjuvant chemoradiation is also considered based on the location, stage, and biology of gastric cancer.

After surgical treatment, recurrences most often occur within the first 3 years postoperatively, and therefore, patients should be screened more closely in this time period; however, at this time there is no definitive evidence for screening intervals and duration [12].

12.5 Hernias

Hernias become more common in the geriatric population as a result of the weakening of the abdominal wall and comorbidities that increase abdominal pressure, like COPD [14]. However, when considering hernia repair in the geriatric patient, one must consider the morbidity and mortality associated with hernia repair in this particular population. These risks include wound infection, wound hematoma, mesh infection, bleeding, respiratory disease, and ischemic heart disease. This is particularly true in the setting of emergency repair which has a higher chance of postoperative morbidity. Hernia complications requiring emergent intervention would include incarceration or strangulation.

12.5.1 Surgical Considerations

Hernia repairs, both inguinal and ventral, are typically repaired either open or laparoscopically. There has been much debate regarding which method is safer and more effective in the geriatric population. A recent review of the literature showed low complication rates for both methods even in the aging patient with a decreased time back to work and lower rates of residual chronic pain postoperatively in the laparoscopic group [15].

12.6 Colorectal Disease

12.6.1 Diverticular Disease

Diverticular disease is one of the most common disease processes in developed countries, and the incidence increases greatly in the geriatric population [16]. Acute inflammation of colonic diverticula, as seen in diverticulitis, can often be managed with nonoperative therapy of bowel rest and antibiotics; however, there are instances in which surgical management is required, which is often associated with significant morbidity.

Table 12.4 Hinchey classification of perforated diverticulitis [18]

I	Pericolonic or mesenteric abscess
II	Pelvic abscess
III	Purulent peritonitis
IV	Feculent peritonitis

In the setting of acute diverticulitis, management will be dependent on the patient clinical picture, and patients can be divided into uncomplicated and complicated diverticulitis. Patients with significant tenderness on exam, who meet SIRS criteria, should be managed with bowel rest and IV antibiotics [17]. Patients should be referred for colonoscopy approximately 6–8 weeks after clinical symptoms have resolved, to screen for neoplasm which may also present like diverticulitis. The American Society of Colon and Rectal Surgeons now recommend that elective colectomy after an episode of uncomplicated diverticulitis is not required and should be considered following a recovery from an episode of complicated diverticulitis. However, the decision for surgery should be individualized to each patient [17].

Complicated diverticulitis is associated with abscess or fistula and may require more aggressive management. Table 12.4 lists the Hinchey classification for perforated diverticulitis and can aid the surgeon in determining management [18]. Stage I and II are often managed with IV antibiotics. In the event of a well-formed abscess and appropriate access, a percutaneous drainage is an option. On the other hand, stage III and IV often warrant emergent surgical exploration, particularly if the patient meets sepsis criteria. Operative management can vary from laparoscopy or laparotomy with colon resection with or without anastomosis, depending on the extent of peritonitis and patient clinical status.

12.6.2 Colorectal Cancer

Colorectal cancer is one of the most common types of cancers worldwide. The risk of colorectal cancer is directly related to age with the median age of diagnosis being 67. Timing and frequency of screening for colon cancer should be tailored to each individual patient. According to the American Cancer Society, in average-risk patients, those with no personal or family history of colorectal cancer, screening should begin at age 45. In patients with at least one first-degree relative with colorectal cancer at any age, screening colonoscopies should begin at age 40, or 10 years prior to the earliest age of diagnosis of the family member. Recommendations for endoscopic resection and frequency of repeat colonoscopies are dependent on what is found on initial screening colonoscopy.

The staging of colorectal cancer is based on a TNM staging system (Table 12.5) [19]. Evaluation for the metastatic disease includes CT chest, abdomen, and pelvis. Carcinoembryonic antigen (CEA) levels are also obtained

Table 12.5 Colorectal cancer TNM classification [19]

TX	Primary tumor cannot be assessed	NX		Regional nodes cannot be assessed	M0		No distant metastasis
T0	No evidence of primary tumor	N0		No regional metastasis	M1	a	Metastasis confined to one organ
T1	Tumor invades submucosa	N1	a	Metastasis in 1 regional lymph node		b	Metastasis to more than one organ
T2	Tumor invades muscularis propria		b	Metastasis in 2–3 regional lymph nodes			
T3	Tumor invades through muscularis propria		c	Metastasis to regional tissues			
T4a	Tumor penetrates through peritoneum	N2	a	Metastasis to 4–6 regional lymph nodes			
T4b	Tumor invades other organs		b	Metastasis to 7+ regional lymph nodes			

Colon cancer staging			
0	Tis	N0	M0
1	T1	N0	M0
	T2	N0	M0
IIA	T3	N0	M0
IIB	T4a	N0	M0
IIC	T4B	N0	M0
IIIA	T1–T2	N1/N1c	M0
	T1	N2a	M0
IIIB	T3–T4a	N1/N1c	M0
	T2–T3	N2a	M0
	T1–T2	N2b	M0
IIIC	T4a	N2a	M0
	T3–T4a	N2b	M0
	T4b	N1–N2	M0
IVA	Any T	Any N	M1a
IVB	Any T	Any N	M1b

and used in the postoperative period for surveillance for possible recurrent disease.

The workup for rectal cancer is similar to that of colon cancer. It is particularly important to determine the distance of the tumor to the anal sphincters, as this distance will determine surgical management [19]. A completion colonoscopy should also be performed in these patients to look for synchronous colonic lesions. The main difference between colon cancer and rectal cancer is the use of neoadjuvant chemotherapy, in addition to surgery and adjuvant therapy. The use of neoadjuvant therapy is recommended by the NCCN for stage II and higher stages of rectal cancers. Neoadjuvant therapy in these patients has been shown to be of benefit for several reasons. The main advantage includes the downstaging of tumors and better local control, which can change the operative management of the tumor and increase chances for sphincter preservation [20, 21].

Postoperatively, follow-up of patients with colorectal cancer is dependent on the stage of colon cancer. Those with stage I and II colon cancer may be followed with repeat colonoscopy within a year postoperatively and then every 5 years if no new polyps are detected [17]. CEA levels should be obtained every 3 months for the first 2 years, regardless of preoperative CEA level. If CEA levels are noted to rise, a metastatic workup is mandated. In stage I and II colorectal cancer, routine adjuvant chemotherapy is not recommended. Neoadjuvant as well as adjuvant chemotherapy may be of benefit in stage IV colon cancer in order to aid in the resectability of the cancer.

The treatment plan for colorectal cancer can be both different and difficult for geriatric patients. Successful treatment includes a multidisciplinary approach that includes surgeons, oncologists, radiation oncologists, anesthesiologists, gastroenterologists, pathologists, and radiologists. Geriatric

patients should have their algorithms individualized based on their own age, comorbidities, functional status, advance directives, frailty, and social situations. More fit patients should be treated like younger patients in terms of an aggressive approach. However, this aggressive approach may not be appropriate for older and more frail patients due to high risk of mortality and morbidity. In the case of rectal cancer, after complete treatment with surgery, radiation, and chemotherapy, the patient may develop permanent bowel habit changes and incontinence or permanent ostomy leading to significant quality-of-life dysfunction. All of these risks must be thoroughly discussed with the patient with a possibility of the change of treatment plans as well as palliation [22].

12.7 Biliary Disease

12.7.1 Acute Calculous Cholecystitis and Choledocholithiasis

The management of acute cholecystitis can be managed operatively and nonoperatively, which can be decided based on surgeon preference and clinical condition of the patient. In acute cholecystitis, while the primary cause is obstruction of the cystic duct, it is associated with a superimposed infectious process, so the treatment is IV antibiotics along with prompt cholecystectomy. However, in the elderly population, particularly those with severe comorbidities that are considered to be a prohibitively high operative risk, a percutaneous cholecystostomy tube can be placed to drain the gallbladder of infected bile [23]. Biliary drainage allows for time to allow the inflammation to resolve, as well as medical optimization prior to interval cholecystectomy.

12.7.2 Acute Cholangitis

Acute cholangitis is an infection of the biliary tree caused by an obstruction of the biliary duct system [23]. Acute cholangitis presents with fever, jaundice, and right upper quadrant abdominal pain (Charcot's triad). The triad becomes Reynold's pentad in the setting of altered mental status and hypotension. Stable patients with cholangitis can quickly decompensate to septic shock and require immediate diagnosis and treatment with fluid resuscitation and broad-spectrum antibiotics. Definitive decompression of the biliary tree as well as drainage of infected bile should be performed promptly. This can be performed endoscopically, percutaneously, or operatively, dependent on the resources available to the institution.

Endoscopic treatment allows for definitive management by relieving the obstruction, whether by removing the obstructing stone or stent placement across an external obstruction [23]. However, percutaneous drainage, during which a drain is placed into the common bile duct, only allows for decompression of the biliary tree above the site of obstruction but does not relieve the obstruction in the duct. Operative management consists of common bile duct exploration with the placement of a T-tube for biliary drainage.

12.7.3 Biliary Pancreatitis

Obstruction of the common bile duct from a stone can cause inflammation to the pancreas from the increased pressure in the ducts proximal to the obstruction. Endoscopic ultrasound along with ERCP allows for diagnosis and treatment, as it allows for stone removal with or without stent placement to prevent future obstructions [23]. Once the pancreatitis has resolved, which can be determined by clinical resolution of abdominal pain, cholecystectomy is warranted to remove the source of gallstones that may cause a recurrence of biliary pancreatitis, preferably prior to discharge.

12.7.4 Surgical Considerations

It is known that the elderly patient population who undergo surgery for treatment of biliary disease in an emergent setting have higher mortality rates than their younger counterparts [24]. However, the morbidity and mortality rates are lower if the patient is allowed to recover from their acute illness and surgery is performed on an elective basis. Therefore, it is important that the surgeon takes these facts into consideration when treating acute biliary disease in the elderly. In the setting of choledocholithiasis, the use of ERCP in an emergent setting has been found to be safe and effective and will allow the patient to undergo medical optimization before elective surgery. In the case where the risks of nonoperative management of cholecystitis strongly outweigh the risk of emergent surgical management, percutaneous cholecystostomy has been found to allow for clinical improvement with >85% rates of clinical improvement, allowing for the patient to undergo cholecystectomy once the acute process has resolved [25].

12.8 Trauma

In the aging population in the United States, it is prudent for the surgeon to be aware of certain considerations that need to be taken when it comes to trauma in the geriatric patient. Trauma is the fifth most common cause of death in the elderly patients, with the most common cause of death resulting from falls [26]. Advanced age is known to be a risk factor for poor outcomes in trauma patients. This increased risk is due to multiple factors, including preexisting medical conditions, medications, and altered baseline mental status.

12.8.1 Initial Evaluation

The American College of Surgeons recommends following the same initial evaluation as any other trauma patient, with

a few special considerations. The elderly trauma patient often has multiple comorbidities which put them at risk for more complications and poorer outcomes than the younger patient [27]. These comorbidities may preclude the trauma patient to nontraumatic events that could complicate their hospital stay, such as acute coronary syndrome, hypovolemia, pneumonia, acute renal failure, cerebrovascular accident, and syncope.

In addition to making the elderly patient more susceptible to nontraumatic events, patients with multiple comorbidities often take multiple medications, and it is important to consider polypharmacy as a cause of their traumatic injury. This patient population also is often on anticoagulation medications, which puts these patients at higher risk of bleeding events that may be devastating. It has been shown that having a rapid anticoagulation reversal protocol in place will lead to better outcomes in the injured patient [28]. Warfarin has multiple modes of reversal, including vitamin K and plasma; however, there are newer prothrombin complex concentrates that contain factors that rapidly reverse the effect of warfarin. On the other hand, patients who are taking direct Xa inhibitors, or direct thrombin inhibitors such as rivaroxaban and dabigatran, do not have rapid means of reversal and must be taken into consideration during initial assessment and management of the geriatric trauma patient.

When taking into consideration a trauma patient's medications, it is also important to be aware of medication side effects that may mask concerning signs or symptoms. For example, a patient who is on a beta-blockade for blood pressure control or atrial fibrillation may not show initial signs of acute blood loss, such as tachycardia, until a significant amount of blood has been lost.

It is crucial that the surgeon not overlook the potential for injuries in the elderly population, as relatively low-risk mechanisms may lead to a devastating injury. The ACS recommends the liberal use of CT scanning to rule out occult injuries [28]. This population is more susceptible to injuries due to physiologic changes related to age. For example, cerebrovascular injury is more common in the elderly due to cerebral atrophy, and fractures are more common despite low-risk mechanisms due to increased bone fragility [26].

Finally, much like in pediatric patients, it is important to be aware of the possibility of non-accidental traumas in the elderly, particularly those who live with relatives or are institutionalized [26].

12.8.2 Post-trauma Care

Taking care of a geriatric patient who sustains traumatic injuries that require hospitalization needs careful assessments and prompt development of treatment and follow-up plans. Historically, the Frailty Index has been used to predict a patient's disposition, whether it be home, short-term rehabilitation, or acute rehabilitation, and should be calculated early in order to aid in timely disposition once the patient has met discharge criteria [29].

When treating the geriatric trauma patient, it is also important to take into consideration any medications being prescribed to the patient, whether it be pain medications, antiarrhythmic agents, diuretics, or antibiotics. The ACS recommends following Beers Criteria [30] when taking into consideration medications being prescribed to patients during their hospital stay in order to prevent further complications in the already fragile patient population.

12.9 Conclusion

Surgery is common in older adults, but older age appears to have assumed less influence as a determinant of adverse outcome as perioperative care has improved. Despite the higher numbers of elderly patients having surgery, mortality and morbidity rates have been declining. As surgery becomes more common, it is important to have knowledge of common conditions and their potential surgical management options to optimize care for older adults.

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