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GERIATRIC GENERAL SURGERY

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The elderly age group is a fast-growing part of the American population. The proportion of the population aged 85 years and older is projected to increase from 4 million to 19 million by 2050. [1] The growing demands of this elderly population include the increasing need for surgical intervention. [2,3] In the United States the number of patients aged 65 years and older who undergo one or more of five common operations exceeds 1 million per year. Data from the National Cancer Institute Surveillance, Epidemiology and End Results Program show that 56% of newly diagnosed cancer and 71% of cancer deaths are in the age group 65 years or older. [4]

Over the past decade increasing numbers of elderly persons have been found to be more fit and active than ever before. Aging is associated with an increase in the incidence of cancer, gastrointestinal disorders, and vascular disorders, and larger numbers of older adults now desire timely surgical intervention so that they can return to their regular activities with the least possible delay. Many retrospective and prospective studies have shown that age alone is not a contraindication to most surgical procedures when adequate attention is paid to peri-operative care. The advent of minimally invasive surgery, both laparoscopic and endoluminal techniques, have resulted in early recovery following surgical intervention. Advantages include decreased length of stay in hospitals, early ambulation, decreased postoperative pain, and earlier return to preoperative levels of functioning.

The present overview updates the discussion of needed research in geriatric general surgery that was published in *New Frontiers in Geriatrics Research* [5] by describing subsequent contributions to the literature. It also includes relevant information on research conducted in younger patients that are indicative of critical issues that need to be addressed specifically in an older population. New findings that address agenda items from *New Frontiers* are described in the section Progress in Geriatric General Surgery. Research that suggests the need for additions to the research agenda is discussed in the section New Horizons in Geriatric General Surgery at the end of the chapter.

We suggest no changes in the Key Questions in geriatric general surgery that were proposed in *New Frontiers:*

GenSurg KQ1: **How can elderly patients at high risk for emergency procedures be identified?**

GenSurg KQ2: **What are the differences in pathophysiology of the disease processes in the older patient leading to surgical emergencies?**

GenSurg KQ3: **What factors impact on procedure-specific risk-benefit projections in elderly patients?**

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METHODS

The MEDLINE database was searched via the DIALOG Information Service. The period covered was from January 2000 to November 2006. The search strategy combined the MeSH terms for specific surgical procedures with terms denoting old age and also with the various terms for risk factors, postoperative care, postoperative complications, comorbidity, mortality, quality of life, prognosis, recovery, outcome, length of stay, and functional status. An additional requirement was that the term *age* or *aged* be present in the title or that the term *age factors* be present in the MeSH heading. The search resulted in 722 references. A final selection from these was made on the basis of a review of titles and abstracts.

PROGRESS IN GERIATRIC GENERAL SURGERY

PROCEDURES AND OUTCOMES

See *New Frontiers*, pp. 85–86.

***GenSurg 1 (Level B)*: Prospective cohort studies of specific surgical procedures are needed to identify the risk factors in the geriatric population for specific negative and positive outcomes.**

New Research Addressing This Question: Our literature search identified relevant research in three areas: abdominal, biliary, and colorectal surgery.

A retrospective review of 125 octogenarians who over a 6-year period underwent major abdominal surgery showed emergency surgical procedures to be associated with increased morbidity in the elderly age group. The mean age of the patients was 84.6 years. Outcomes measured were whether complications developed, 30-day mortality, and whether there was return to premorbid function. Nearly half were emergency cases. Most operations were on the stomach, small bowel, or large bowel. Multivariate analysis revealed emergency operations to be associated with significantly increased odds of morbidity. Likewise, a poor American Society of Anesthesiologists (ASA) classification, a comorbidity index greater than 5, development of acute coronary syndrome, and anastomotic leakage were also found to significantly increase the odds of morbidity. Low serum albumin and hemoglobin and renal impairment were also predictors of adverse outcome. For elective cases, 82.8% of patients were able to return to their premorbid functional status. The study suggests that efforts to improve outcome in geriatric surgery patients should emphasize a shift toward elective surgery and away from emergency surgery and should also target the optimization of predictors of adverse outcome. [6]

Fifty percent of women and 16% of men in their 70s have been shown to have gallbladder disease, and 20% of the abdominal procedures performed in those older than 80 years are hepatobiliary. In a retrospective study of 5884 patients undergoing laparoscopic cholecystectomy, it was demonstrated that patients aged 70 years and older have a twofold increase in complicated biliary tract disease and conversion rates over those seen in younger patients. Pulmonary and cardiac complications were common in the elderly patients. Complicated biliary disease resulted in a nearly tenfold increase in conversion rate for patients aged 65 years and older, with an increase in morbidity to 27% for patients undergoing conversion. [7] The rate of conversion from a laparoscopic procedure to an open

procedure is higher in emergency cases. This was evaluated in a series of 117 patients aged 80 years and older (median age 83 years) undergoing laparoscopic cholecystectomy. The conversion rate was 3% in elective cases and 10% in emergency cases. [8]

A study of bile duct injuries during cholecystectomy reported that the adjusted hazard ratio for death during the follow-up is significantly higher for patients with a common bile duct injury than for those without injury, and the hazard significantly increases with advancing age and comorbidities and decreases with the experience of the surgeon. Complicated gallstone or bile duct disease might necessitate referral to an experienced hepatobiliary surgeon for improvement in the outcomes of elderly patients undergoing laparoscopic cholecystectomy. The risk of bile duct injuries increases with age, male sex, and a low annual hospital volume of cholecystectomies. [9]

In a prospective study comparing presenting findings and outcomes in patients younger than 50 years and 50 years or older (N = 519) with appendicitis, the presence of symptoms for longer than 24 hours was found to be significantly more common in the older group. Complication rates were also significantly higher (20% versus 8%) in the older group, as were mortality rates (2.9% versus 0.24%) and perforation rates (35% versus 13%). [10] Increasing time between appendicitis symptom onset and treatment may be a risk factor for a ruptured appendix, but little is known about how the risk changes with passing time. A retrospective chart review revealed that the risk of rupture is greater in patients with 36 hours or more of untreated symptoms and age of 65 years and older. This study suggests that, especially in the elderly population, delaying surgery beyond 36 hours from symptom onset results in higher risk of rupture and increased morbidity. [11]

Colorectal emergency requiring radical surgery is becoming more common in the older age group, and problems remain as regards the best management policy. A retrospective study evaluated 105 elderly patients, aged 65 years and older, with colorectal disease who underwent an emergency operation. Forty-five patients had benign disease, with a predominance of diverticulitis, and 60 patients had colorectal carcinoma. A resection operation either with primary anastomosis or Hartmann's procedure was performed in 75% of cases; in the rest, only palliation was achieved. Forty-three percent of the patients with colorectal cancer emergency were aged 80 years or older. The mortality rate was higher for patients with perforation than for those with obstruction. Advanced age was found not to be a contraindication to radical surgery for colorectal emergency. In the majority, a resection operation was feasible. In high-risk patients, colostomy was found to be a life-saving alternative. [12]

Modification of This Question in Light of New Research: Further studies are indicated in the elderly population to assess whether postoperative outcomes and quality of life are improved when older adults are offered elective surgery for chronic conditions such as chronic cholecystitis, recurrent gallstone pancreatitis, or chronic diverticulitis. Elderly patients often have multiple comorbidities that can increase the risk of poor outcomes when surgery is performed for acute and complicated biliary disease or complicated diverticulitis following two or more episodes of diverticulitis. These studies will help to re-evaluate the practice of elective resection as a strategy for reducing the mortality and morbidity from complicated intra-abdominal pathology.

GenSurg 2 (Level B): **Prospective studies are needed to compare outcomes in younger and older patients for specific surgical procedures in outpatient settings or with short hospital stays. For example, is it**

possible to safely perform laparoscopic antireflux surgery in older patients with a 23-hour hospital stay?

New Research Addressing This Question: Ultra-short anesthetic agents and advances in the ability to monitor the depth of anesthesia have helped to improve anesthetic recovery in elderly patients following outpatient surgery. This has resulted in quicker recovery from anesthesia, with decreased nausea and vomiting. Postoperative cognitive dysfunction still remains a problem in a small proportion of elderly patients. [13]

While the success of outpatient and short-term inpatient laparoscopy still can be assured only by surgeons' high experience and minimal complications, several other factors contribute to good outcomes. These include meticulous attention to detail in the preoperative assessments, efficient postoperative management, a reliable social setting, and collaboration with local physicians involved in primary care of the patient. [14] Several studies have shown that laparoscopic cholecystectomy, hernia repairs, and fundoplication can be performed safely in a hospital-affiliated outpatient setting, resulting in a significant reduction in procedure costs. Most patients studied were ASA grade I or II. [15–17]

Modification of This Question in Light of New Research: These studies included but were not limited to elderly patients. Prospective studies are still needed to stratify elderly patients according to their suitability for outpatient surgery.

***GenSurg 3 (Level B)*: Case-control studies are needed to identify factors that place elderly patients at high risk for requiring emergency surgical procedures.**

New Research Addressing This Question: Elderly patients with longstanding symptomatic cholelithiasis and chronic cholecystitis are at increased risk for developing gallstone pancreatitis, acute gangrenous cholecystitis, and possible gallbladder perforation. These conditions are associated with significant morbidity and occasionally are difficult to diagnose, as can be the case with gallbladder perforation. In the study detailed here, data were collected prospectively over a 10-year period of patients undergoing laparoscopic cholecystectomy. Two hundred eight of 11,360 patients who underwent cholecystectomy were diagnosed with gangrenous cholecystitis, and 30 were diagnosed with gallbladder perforation. In comparison with patients with gangrenous cholecystitis, patients with gallbladder perforation presented at an older age (53 versus 60 years; $P < .05$), had more cardiovascular comorbidity (29% versus 50%; $P < .05$) and postoperative complications (19% versus 37%; $P < .05$), required more intensive care unit admissions (9% versus 33%; $P < .001$), and had longer hospital stays (8 versus 13 days; $P < .001$). Early cholecystectomy within 24 hours was found to improve outcome ($P < .05$). [18] An additional risk factor for elderly patients is the increased risk of biliary tract disease in postmenopausal women using estrogen therapy. [19]

Retrospective studies have been conducted to evaluate outcomes in patients presenting with acute cholecystitis, mild acute pancreatitis, or cholangitis who were treated conservatively. In one such study, 42% of the patients who did not receive cholecystectomy at the time of the first admission subsequently presented again to the emergency department, and 70% of all the patients studied required further inpatient admission related to gallstone-associated pathology within the study period; 61% underwent cholecystectomy at a median range of 70 days from index admission. [20] Similar studies are needed in the elderly population, as the morbidity associated with repeat presentation with symptoms is

high in this patient population. This is critical in patients with gallstone pancreatitis, in whom delay of laparoscopic cholecystectomy for more than 4 weeks after gallstone pancreatitis is associated with a high unplanned readmission rate, even with liberal use of preoperative cholangiography. [21]

Three factors have been shown in one study to predict a high mortality rate in elderly patients, aged 70 and over, who undergo emergency surgery for complicated colorectal carcinoma. These are peri-operative transfusion, a high Acute Physiology and Chronic Health Evaluation (APACHE II) score, and the presence of perforation proximal to the tumor. This study suggests that the presence of these factors and the knowledge that they can independently predict mortality can help determine the operative plan and the need for more intensive postoperative care. [22]

Modification of This Question in Light of New Research: Better understanding of predictors of the need for emergency surgery in the elderly population is still needed. Prospective studies comparing outcome measures following elective or emergent surgery are also needed.

***GenSurg 4 (Level B)*: Basic studies are needed to elucidate the differences in pathophysiology of the diseases and disorders in the elderly patient that lead to a high risk of requiring emergency surgical procedures.**

New Research Addressing This Question: The age-associated decline in liver function may be caused by mechanisms operating on the cellular level, such as age-associated mitochondrial damage in hepatocytes, functional decline of Kupffer cells, and defects of the respiratory chain in the liver during aging. One study found advanced age to be associated with a higher incidence of choledocholithiasis ($P = .01$) and an increased incidence of complications probably secondary to increased incidence of inflamed or scarred gallbladder or the presence of choledocholithiasis. [23] The presentation of peptic ulcer disease in the elderly patient is more subtle and atypical than in younger patients. With the increase in prevalence of *Helicobacter pylori* infection in the elderly age group, there has been a concomitant increase in the incidence of peptic ulcer disease in this population. [24] *H. pylori* infection and the use of nonsteroidal anti-inflammatory drugs (NSAIDs) are independent risk factors for peptic ulcer disease. NSAIDs and selective serotonin-reuptake inhibitors together can increase the risk of gastrointestinal bleeding. [25]

Modification of This Question in Light of New Research: The risk factors in elderly patients for emergency surgery still need to be determined to help prospectively identify those who should receive early elective intervention.

***GenSurg 5 (Level A)*: Guidelines for educating physicians to recognize diseases and risk factors that might predict an older patient's need for emergency surgical procedure should be developed; the guidelines would be based on findings of the research recommended in GenSurg 3 and GenSurg 4.**

New Research Addressing This Question: With the steady increase in the aging population, there has been a rise in both elective and emergent surgical procedures in patients aged 70 years or older. A retrospective study of 469 such patients assessed the effect of sex, type of admission, main surgical diagnosis, benign or malignant nature, site of dis-

ease, concomitant disease, and preoperative ASA grade on postoperative outcomes. The incidence of various procedures for specific indications was as follows: Hepatopancreatic biliary conditions, 39.6%; colorectal, 19.4%; hernia, 18.8%; upper gastrointestinal, 15.3%; and endocrine disease, 6.9%. The study concluded that factors that increased the risk of postoperative death were the emergency nature of the surgery, the presence of comorbidities, an ASA score of III-V, and upper gastrointestinal surgery. [26]

Scoring systems for the enumeration of morbidity and mortality are useful predictors of postoperative outcomes, but they have to be validated within individual practices. Studies comparing the observed morbidity and mortality in patient populations following a given procedure need to be compared with values predicted by specific scoring systems to check for concordance. A study examined the validity of a physiology and operative severity score for enumeration of mortality and morbidity (POSSUM) [27] in predicting morbidity and mortality in 76 patients aged 80 and older undergoing laparoscopic cholecystectomy. Patients were identified from the surgical operations database of one hospital. Information on clinical and operative factors as described in POSSUM was collected. The ratios of observed to POSSUM-estimated morbidity and 30-day mortality were calculated. Observed and POSSUM scores were similar in predicting morbidity. However, POSSUM scoring overpredicted mortality in this patient population. [28]

Modification of This Question in Light of New Research: Scoring systems should be used to modify peri-operative care for elderly patients undergoing emergent procedures, and observational studies should be carried out to evaluate the effect of such interventions on outcomes following surgery.

ENDOCRINE DISEASE

Parathyroid Disease

See *New Frontiers,* p. 87.

***GenSurg 6 (Level B)*: Research is needed to determine the effect of hyperparathyroidism on quality of life, longevity, functional status, and cognitive status of older patients.**

New Research Addressing This Question: Evaluation of the quality of life following parathyroidectomy is critical. A study conducted over 16 months evaluated the health-related quality of life of 61 patients following parathyroidectomy for hyperparathyroidism. The mean age of patients in the study was 61 years. The patients filled out health status questionnaires preoperatively and during two subsequent postoperative visits, and the results were evaluated. During the postoperative visits, patients' perception of their general health, muscle strength, energy level, and mood showed significant improvement ($P < .05$), suggesting that parathyroidectomy for hyperparathyroidism is associated with marked improvement in a patient's quality of life. [29,30] These and other studies were not targeted solely on the study of elderly patients. However, a retrospective analysis of 54 patients aged 80 years or older with symptomatic primary hyperparathyroidism showed similar improvement in symptoms of fatigue, weight loss, bone pain, depression, and constipation following parathyroidectomy. [31]

Primary hyperparathyroidism is one of the risk factors for bone loss, osteoporosis, and fractures in elderly people. A cohort study of 3213 patients with a mean age of 61 years and a diagnosis of primary hyperparathyroidism compared the effects of surgery (60%)

with nonsurgical management (40%). Patients who underwent surgery were found to have a lower incidence of fractures (hazards ratio 0.69, 0.56 to 0.84) and gastric ulcers (0.59, 0.41 to 0.84). Mortality was lower in the patients who were treated surgically. There was no difference in the occurrence of cardiovascular events following surgical intervention or following nonsurgical treatment. [32]

Improvement of cognitive impairment following parathyroidectomy is one of the expected benefits of the procedure. It has not been proven conclusively that cognitive impairment caused by hyperparathyroidism can be reversed by parathyroidectomy. However, case studies of three patients, two women aged 79 and 80 and a man aged 84, revealed cognitive impairment caused by primary hyperparathyroidism. In these three patients, parathyroidectomy led to a marked improvement in the symptoms. [33]

Modification of This Question in Light of New Research: Further studies are needed to evaluate improvement in symptoms, progression of osteoporosis, and cognitive function in elderly patients following parathyroidectomy.

***GenSurg 7 (Level B)*: Observational comparison of older and younger patients is needed to suggest whether hyperparathyroidism is recognized and treated surgically in the same percentage of older and younger patients.**

New Research Addressing This Question: Although primary hyperparathyroidism is common in elderly patients, referral for parathyroidectomy may be delayed because of concerns regarding the fitness for surgery of older persons and the perceived risk of increased morbidity and mortality in this age group. A retrospective analysis of 54 patients aged 80 years and older with primary hyperparathyroidism was conducted. Twenty-two percent of these patients had a mean delay of 5 years before a surgical referral was requested. [31] The concern regarding the morbidity associated with anesthesia and surgical stress of parathyroidectomy has decreased with the advent of minimally invasive parathyroidectomy. [34]

Modification of This Question in Light of New Research: Further studies are needed to evaluate the benefit of early referral of elderly patients with symptomatic hyperparathyroidism. Studies are also needed to determine whether minimally invasive parathyroidectomy can offer a reliable and safe alternative for the elderly patient with multiple comorbidities. Comparisons of treatment modalities and outcomes between younger and older patients are also needed.

Thyroid Disease

See *New Frontiers,* p. 87. For a new agenda item, see the subsection on thyroid disease in New Horizons in Geriatric General Surgery at the end of the chapter.

BREAST CANCER

See *New Frontiers,* pp. 88–90. For new agenda items, see the subsection on breast cancer in New Horizons in Geriatric General Surgery at the end of the chapter.

***GenSurg 8 (Level A)*: Randomized controlled trials should be performed to determine the effect of screening mammography on survival,**

treatment morbidity, functional outcomes, and costs as a function of age.

New Research Addressing This Question: The annual breast cancer mortality rate declined between 1987 and 1997. However, this decline was only 9% for women aged 70 to 79 years, much lower than the 19% for women aged 20 to 49 and the 18% for women aged 50 to 69. The difference may be due to the fact that older women are not screened as vigorously as younger women or that they receive less aggressive treatment. [35,36]

Breast cancer—specific mortality has been found to be higher in the younger woman (aged 55 to 64 years). In this group, 75% of deaths are a result of breast cancer, but this is true in only 27.6% of women aged 85 and older. The majority of elderly breast cancer patients present with stage I and II disease. However, despite this stage distribution, most elderly patients undergo modified radical mastectomy instead of breast conservation surgery. [36]

The screening studies available for detecting breast cancer are self-examination, physical examination by a health care professional, and mammography. Other avenues being explored are digital mammography and magnetic resonance imaging. The use of mammography in older women does affect survival. Women undergoing at least two mammograms between age 70 and 79 have shown a 2.5-fold reduction in cancer-related mortality. [37] Mammography has also shown reduced mortality in women up to the age of 85 in spite of the presence of moderate comorbidities. [38]

The value of obtaining routine mammograms in women aged 65 years and older has not been documented. The American Geriatrics Society position statement recommends annual or at least biennial mammography until age 75 and biennially or at least every 3 years thereafter, with no upper age limit for women with an estimated life expectancy of 4 or more years. [39] Previous studies had suggested that screening mammography could reduce the mortality rates from breast cancer between the ages of 50 and 69 and that this advantage could extend to patients aged 70 to 74 years. A retrospective cohort study evaluated the relationship between the use of screening mammography and the size and stage of breast cancer at the time of diagnosis in 12,038 older women who received a diagnosis of breast cancer over a 2-year period. The results indicated that women aged 75 years and older are less likely to have undergone a screening mammogram than women aged 69 to 74 years. More importantly, an increase in the use of mammography was found to be associated with smaller tumor size and a lesser stage of cancer at the time of diagnosis. This finding is more significant in older women than in younger women. [40]

A retrospective cohort study conducted in women aged 67 years and older sought to establish the relationship between the use of mammography, stage of the breast cancer at the time of diagnosis, and breast cancer mortality. The 11,399 women in the study were divided into three age groups: 67 to 74 years, 75 to 85, and 85 or older. Lack of use of mammography was found to be associated with a higher incidence of presentation with stage II or higher advanced breast cancer in all age groups. For all women, but especially for women between the ages of 67 and 85, lack of mammography is significantly associated with an increase in the risk of dying from breast cancer. [37]

Modification of This Question in Light of New Research: Questions that remain to be answered are whether physical breast examination is as effective as mammography in older women and whether mammograms should be performed at intervals longer than 1

year in women over 70 years age. Such research will lead to the establishment of evidence-based guidelines for the use of routine mammography in older women. Studies are also needed to evaluate differences in outcomes when older women are screened as vigorously as their younger counterparts and receive similarly aggressive treatment.

> ***GenSurg 9 (Level A)***: **Randomized controlled trials of breast cancer therapy in older women should be performed to compare the use of tamoxifen alone with the use of tamoxifen plus surgery in subgroups of ages ranging from 50 to 90 years. Outcomes measured would include survival, treatment morbidity, function, and cost. Subgroup analyses would identify which patients are likely to respond well to tamoxifen alone.**

New Research Addressing This Question: The 2001 St. Gallen Seventh International Consensus Panel recommends that postmenopausal women with breast cancer (with the exception of those who are low-risk node-negative patients and those who are estrogen-receptor negative) should receive 5 years of tamoxifen therapy. [41] However, several studies show that older women are less likely than younger women to receive tamoxifen. A study of patterns of adjuvant tamoxifen prescription and patterns of discussion regarding such therapy between patients and physicians revealed that older patients (those aged 80 years and older, those with multiple comorbidities, and those with estrogen receptor–negative status) were less likely to report discussion regarding tamoxifen therapy with their physicians. [42]

In a cohort study of 5464 women diagnosed with node-positive operable breast cancer, adjuvant chemotherapy was found to result in improved survival only in patients aged 65 to 69. No benefit was seen in patients aged 70 years and older, [43] similar to what had been seen in previously published randomized clinical trials. Collaborative meta-analyses of 194 unconfounded randomized trials of adjuvant chemotherapy and hormonal therapy started in 1995 have yielded interesting results. Six-month treatment with anthracycline-based polychemotherapy with FAC (fluorouracil/Adriamycin/cyclophosphamide) or FEC (fluorouracil/epirubicin/cyclophosphamide) reduced the annual breast cancer death rate by 38% in women younger than 50 years and by 20% in women aged 50 to 69. These results were found to occur regardless of estrogen-receptor status, nodal status, tumor characteristics, and use of tamoxifen. Unfortunately, women aged 70 or older were not included in the study. More interestingly, the use of tamoxifen for estrogen receptor–positive disease reduced the annual death rate by 31% regardless of the use of chemotherapy, age, progesterone-receptor status, and other tumor characteristics. This included patients aged 70 years and older. [44]

The European Organization for Research and Treatment of Cancer 10851 trial randomized women aged 70 years and older to modified radical mastectomy or to tamoxifen 20 mg daily for life. Median follow-up was 11.7 years in the mastectomy group and 10.2 years in the tamoxifen group. [45] This trial was preceded by two earlier trials—the Nottingham City trial comparing wedge resection with tamoxifen (20 mg twice daily) and the St. George's trial comparing total mastectomy or wide local excision versus tamoxifen alone (20 mg daily for 2 years). [46] All three trials showed that overall survival and breast cancer-specific survival were equivalent with operation or tamoxifen.

Surgery as a primary treatment modality offers the best chance for local control. Progression of disease while on tamoxifen therapy requires subsequent surgical intervention

in a large number of patients. The optimal treatment for breast cancer in a woman who is physically fit is surgery, not endocrine therapy. [47] It has been suggested, therefore, that primary endocrine therapy should be reserved for selected patients with multiple comorbidities, those with limited life expectancy, and those who refuse surgical treatment.

Modification of This Question in Light of New Research: Further studies are needed to evaluate the outcomes of adjuvant tamoxifen therapy in older postmenopausal women with breast cancer (with the exception of those with low-risk node-negative status and estrogen receptor–negative status).

GenSurg 10 (Level A): **Randomized controlled trials are needed to determine the minimum duration of tamoxifen therapy that is required for optimal effect in older breast cancer patients.**

New Research Addressing This Question: Although tamoxifen therapy is the gold standard adjuvant treatment in estrogen receptor–positive early breast cancer, it does have several disadvantages. Patients undergoing tamoxifen therapy are at increased risk of endometrial cancer and other life-threatening events. They may also develop resistance to tamoxifen. This has led to a keen interest in developing alternatives to tamoxifen. A prospective randomized trial was planned in which, following 2 to 3 years of tamoxifen treatment, patients were randomly assigned either to receive anastrozole (aromatase inhibitor) 1 mg per day or to continue receiving tamoxifen 20 mg per day, for a period of 5 years. A total of 448 patients with node-positive, estrogen receptor–positive tumors were enrolled, and disease-free survival was measured over a period of 36 months. Disease-free survival and local recurrence–free survival were significantly longer in the anastrozole group ($P = .0002$). [48]

Overall survival was assessed in a randomized prospective study of women between the ages of 50 and 70 years with T1-3, N0-3 breast carcinoma. They were randomized to 2 years versus 5 years of adjuvant tamoxifen, and studies were performed after 12 years of follow-up. In studying the entire population and patients who were estrogen-receptor positive, the researchers concluded that tamoxifen usage did not affect overall survival. However, in younger patients (aged 55 or younger) with estrogen receptor–positive disease, the 5-year treatment was found to be associated with a 44% decrease in the risk of death. This advantage was not present in the older age group. [49]

One study conducted a 10-year follow up of 18,000 women with breast cancer in 47 randomized trials of chemotherapy. The study showed that younger women, those aged under 50 years, who were treated with chemotherapy gained a significantly increased relapse-free survival (average of 10.3 months) and an overall survival (average of 5.4 months) in comparison with patients in the no-treatment group. The same benefit was seen in older women, aged 50 to 69 years, who received chemotherapy, also in comparison with older women in the no-treatment group. When the older and younger women in the chemotherapy group were compared, the size of the benefit for the older women was found to be less. Even within this group, however, there was a smaller subgroup of patients who had estrogen receptor–negative tumors and therefore did not receive tamoxifen. In this subgroup, the benefits of polychemotherapy were comparable to those seen in the younger patients. [50]

Modification of This Question in Light of New Research: Further studies are needed to evaluate the impact of switching to anastrozole after the first 2 to 3 years of treatment with

tamoxifen in patients with early breast cancer who are aged 70 years and older. Discussions are warranted as to whether the overall benefit of a treatment modality should be determined by comparison with younger patients undergoing similar treatment or with older patients who do not undergo the treatment.

***GenSurg 11 (Level A)*: Randomized controlled trials are needed to compare rates of recurrence and survival in groups of older breast cancer patients who are treated with and without axillary dissection.**

New Research Addressing This Question: The presence of multiple comorbidities in the older patient can limit interventions such as an axillary node dissection and can affect decisions regarding the type of surgery and subsequent adjuvant therapy.

A cohort study of 464 women aged 64 years or older who were newly diagnosed with breast cancer (stage I or II) and undergoing breast-conservation surgery yielded interesting results. Most of the women studied, 63.4%, also underwent axillary node dissection. Although increasing age was associated with decreasing odds of node dissection, it was found that irrespective of age, women in the lowest quartile of physical functioning were less likely to undergo axillary node dissection than those with excellent functioning. Also, patients cared for by surgeons with special training in oncology were less likely to undergo node dissection. Age, therefore, does not seem to be the only determinant in the decision regarding whether or not to proceed with axillary node dissection in older women with stage I or II breast cancer. [51]

The utility of sentinal lymph node (SLN) dissection in determining subsequent therapy was evaluated in a prospectively collected breast cancer SLN mapping database. A total of 730 breast cancer SLN mapping patients were studied; 261 (35.8%) were aged 70 years or older. Axillary lymph node dissection was performed in 88.9% of patients with metastases detected by hematoxylin and eosin stain, and 84.65% of patients with metastases documented by immunohistochemistry. Hormonal and cytotoxic chemotherapy were administered more frequently (86.9% and 24%) in SLN-positive patients than in SLN-negative patients (54.3% and 2.8%). In the patients studied, SLN status affected treatment algorithms. With a mean follow-up of 15.4 months, 8.2% of patients with positive SLN developed distant metastases, as compared with no patients with negative SLN. [52]

Another retrospective study evaluated SLN biopsy using smaller-sized tin colloid in 122 patients; 40 patients were over 60 years of age and 82 patients were 60 years or younger. The 95% confidence intervals (CI) for successful mapping rate, false negative rate, and accuracy of the two groups overlapped. It was concluded that SLN biopsy can therefore be feasible and useful in elderly patients. [53]

Modification of This Question in Light of New Research: The results of SLN mapping and biopsy in elderly patients significantly influences subsequent therapy decisions, including axillary lymph node dissection, hormonal therapy, and cytotoxic chemotherapy. The effect of regularly recommending SLN mapping and biopsy and axillary lymph node dissection in elderly women should be evaluated.

STOMACH DISORDERS

See *New Frontiers*, pp. 91–93. For new agenda items on gastroesophageal reflux disease (GERD) and achalasia, see the subsections on these conditions in New Horizons in Geriatric General Surgery at the end of the chapter.

Ulcer Disease

See *New Frontiers,* p. 92.

***GenSurg 12 (Level B)*: Observational cohort studies are needed to determine if presentation and pathophysiology of peptic ulcer disease are different in older people.**

New Research Addressing This Question: Elderly persons are known to be at higher risk for GERD, pill-induced esophagitis, peptic ulcer disease, and complications of NSAID use. [54] Retrospective studies of patients who underwent surgery for treatment of peptic ulcer disease over a 15-year period showed that for elderly patients the percentage requiring emergency surgical intervention is significantly higher than for their younger counterparts. The older patients are also more likely to present with hemodynamic instability and require a longer hospital stay. NSAID use was also found to be higher in the elderly age group. [55]

Modification of This Question in Light of New Research: Future studies should evaluate the effects of endoscopic surveillance of elderly patients presenting with new-onset symptoms of ulcer disease.

***GenSurg 13 (Level B)*: Prospective cohort studies are needed to seek clues as to how complications of peptic ulcer disease in older patients can be prevented.**

New Research Addressing This Question: One of the ways in which it may be possible to reduce the incidence of acute presentations would be to recommend endoscopy for identification of mucosal disease in patients who are older than 45 years and who present with new-onset weight loss, vomiting, anemia, dysphagia, or gastrointestinal bleeding. [54]

Modification of This Question in Light of New Research: Future studies should evaluate the effects of follow-up and possible endoscopic surveillance of elderly patients who have previously undergone surgery for peptic ulcer disease and who present with recurrent symptoms.

***GenSurg 14 (Level B)*: Cohort studies on older patients are needed to identify risk factors for peptic ulcer disease.**

New Research Addressing This Question: Presentation of peptic ulcer disease in the elderly patient is more subtle and atypical than in the younger patient. With the increase in prevalence of *H. pylori* infection in the elderly age group, there has been a concomitant increase in the incidence of peptic ulcer disease in these patients. [24] *H. pylori* infection and NSAIDs use are independent risk factors for peptic ulcer disease. NSAIDs with selective serotonin-reuptake inhibitors together can increase the risk of gastrointestinal bleeding. [25]

Modification of This Question in Light of New Research: Future studies are needed to evaluate the ability of gastroprotective agents to cause a decrease in the rate of gastrointestinal bleeding in patients on NSAIDs and selective serotonin-reuptake inhibitors. Observational studies are needed to evaluate the effect of substituting alternatives to NSAIDs in the elderly population.

***GenSurg 15 (Level B)*: Observational cohort studies are needed of putative methods to reduce the morbidity and mortality of emergency operations for peptic ulcer disease in older patients.**

New Research Addressing This Question: Management of peptic ulcer disease in the elderly patient is a challenging task. There is an increase in the number of elderly patients presenting with complications of peptic ulcer disease such as perforation and bleeding. Observational studies evaluating 13 patients older than 70 years of age and presenting with perforated gastric ulcer were carried out in a tertiary hospital from 1995 to 2003. Surgical procedures performed were simple closure with an omental patch in 11 patients and antrectomy in 2 patients. Three patients died in the postoperative period. Of these, 2 were transferred from an outside hospital. The study also included 28 elderly patients with a mean age of 79.6 years with bleeding gastric ulcer who were admitted during the same period. All patients were managed with medical therapy and endoscopic intervention. The study concluded that early diagnosis and treatment were the two main factors that resulted in favorable outcomes in elderly patients presenting with perforated gastric ulcers. Medical management and endoscopic intervention were successful in controlling gastric ulcer bleeding in elderly patients. The need for surgery in these cases was found to arise only after two failed endoscopic interventions. [56]

A prospective cohort study was carried out in 96 patients presenting with perforated peptic ulcer in order to assess the predictors of the risk, rate, and number of postoperative complications. Patients underwent either a Graham patch closure or a gastrojejunostomy with total truncal vagotomy. The results showed that comorbidities, abdominal distension, and the need for blood transfusion were risk factors for postoperative complications and for the higher number of such complications. The rate of development of complications was influenced by a history suggestive of shock and A− blood group. This study documents the need for early recognition of the above-mentioned risk factors so that postoperative management can be optimized, resulting in improved outcomes. [57]

Modification of This Question in Light of New Research: GenSurg 15 has been answered and can be dropped from the research agenda.

***GenSurg 16 (Level A)*: Randomized controlled trials of the most promising method for reducing the morbidity and mortality of emergency surgery for peptic ulcer disease in older patients are needed.**

New Research Addressing This Question: One study enrolled 72 consecutive patients to evaluate the role of intensive resuscitation in the outcome of patients with upper gastrointestinal bleeding. The factors thought to be associated with increased morbidity and mortality are age, associated comorbidities, and hemodynamic stability. To prevent bias in comparing improperly balanced patient groups, the groups were designed to be similar with respect to variables such as age, shock, comorbid conditions, cause of bleeding, and major stigmata of recent hemorrhage. Both groups had 36 patients, with 22/36 in the observational group with peptic ulcer disease and 24/36 patients in the intensive resuscitation group with peptic ulcer disease. Other causes of bleeding included esophageal varices, esophageal ulcers, and malignancy. Irrespective of age, timely correction of hemodynamic instability, correction of hematocrit, and coagulopathy resulted in decreased morbidity and mortality ($P = .04$). [58]

Modification of This Question in Light of New Research: Similar studies are needed focusing solely on elderly patients with stratification based on their comorbidities and specifically on patients with ulcer disease.

***GenSurg 17 (Level B)*: Cohort studies are needed to seek alternatives to nonsteroidal anti-inflammatory drugs for use by older patients.**

New Research Addressing This Question: No research of the type recommended has been done.

Modification of This Question in Light of New Research: Alternatives to NSAIDs that may be beneficial for use by older patients are needed. This item should remain on the research agenda.

***GenSurg 18 (Level A)*: As possibly safer nonsteroidal anti-inflammatory drugs are developed, they should be tested in randomized controlled trials for safe use by older patients.**

New Research Addressing This Question: No research of the type recommended has been done.

Modification of This Question in Light of New Research: This item should remain on the research agenda.

Gastric Cancer

See *New Frontiers,* pp. 92–93.

***GenSurg 19 (Level B)*: Outcome studies and prospective cohort studies are needed to build evidence as to optimum treatment for each stage of gastric cancer, including ways to palliate the near-terminal and terminal phases.**

New Research Addressing This Question: The incidence of gastric cancer is increasing in elderly patients, though not in younger patients. The higher mortality observed in the elderly patients and the poor survival rate leads to a surgical approach that mostly tends to palliate symptoms rather than obtain a curative resection. [59]

One study analyzed outcomes for 3431 patients treated for gastric cancer between 1977 and 1998. Patients in group 1 were aged 70 years or older and in group 2 were younger than 70 years. The incidence of intestinal type (Lauren classification) and distally located cancers were higher in the older age group. Total gastrectomies and extended lymph node dissection were performed more commonly in the younger group. There was a significant difference between the groups in 5-year survival: 24% for group 1 and 35% for group 2. Following more radical procedures, the 5-year survival increased: 35% in group 1 and 53% in group 2. The researchers concluded that surgical resection is therefore the treatment of choice for gastric cancer and that advancing age is not a contraindication. [60]

One study found postoperative complications and mortality rates to be higher in elderly patients undergoing resection for gastric cancer. However, in this patient population it may be beneficial to use biological markers to determine if they will benefit from preoperative high-dose chemotherapy. Positive p53 immunostaining and positive p53 mutation status before chemotherapy and histologic regression following high-dose chemotherapy followed by surgical resection has been shown to be associated with prolonged overall sur-

vival. These studies were conducted in 25 patients, 3 of whom were aged 60 years or older. [61] The use of a Comprehensive Geriatric Assessment tool that takes into account the individual operative risk can help optimize the choice of treatment. [62]

A study of 135 elderly patients (aged 75 years or older), and 665 middle-aged patients (45 to 65 years old) with gastric cancer undergoing surgery noted distinct characteristics in the elderly patients. These included a predominance of males and advanced-stage disease; also, deaths from other cancers and comorbid disease were more common in the elderly group. The authors concluded that follow-up and management of their other diseases would improve survival of elderly gastric cancer patients. [63]

Laparoscopic hand-assisted surgery for early gastric cancer in young and elderly patients has been evaluated to test the feasibility of the procedure and to compare outcomes. The controls were patients undergoing standard open gastrectomy. Blood loss was found to be less in elderly patients undergoing laparoscopic surgery than in younger patients and control patients. The overall 5-year survival rates were not significantly different in the elderly and younger groups. [64]

The utility of gastrojejunostomy for the palliation of gastric outlet obstruction in irresectable or incurable gastric carcinoma was investigated in a retrospective review of 67 patients who underwent a gastrojejunostomy for gastric outlet obstruction caused by gastric carcinoma. Sixty patients were discharged from hospital once they had resumed normal eating. Their median survival after surgery was 9 months, which suggests that gastrojejunostomy offers worthwhile palliation and possibly prolongs survival for this significant group of patients. [65]

Palliative procedures are often indicated in patients with advanced biliary and pancreatic tumors. Placement of self-expandable metal stents inserted either endoscopically or under fluoroscopic control has shown encouraging results. A retrospective study of 33 patients who had a metal stent positioned was conducted. They ranged in age from 45 to 94 years, with a mean age of 75. Indications were a pancreatic adenocarcinoma (27 patients), a stricture of a gastrojejunal anastomosis due to recurrent pancreatic tumor (4), and a stricture of a gastrojejunal anastomosis secondary to gastric cancer surgery (2). There were no immediate complications. Improvement in the quality of life was obtained in all patients, with a median duration of hospitalization of 8 days and mean survival rate of 12 weeks. Such palliative procedures have therefore been shown to be safe and well tolerated, and to demonstrate improved quality of life. [66]

Modification of This Question in Light of New Research: Future studies can be conducted prospectively in elderly patients presenting with gastric cancer at various stages to determine which stage and which biological marker profile can help determine the treatment that carries the least morbidity and mortality with overall good outcomes.

***GenSurg 20 (Level B)*: Cohort or outcome studies are needed to gain information about the effectiveness of using newer treatment methods, such as photodynamic therapy, for treating elderly patients with stomach disorders.**

New Research Addressing This Question: The therapeutic efficacy of endoscopic photodynamic therapy for advanced gastric cancer is limited. In one small study, immunotherapy combined with photodynamic therapy was evaluated in two elderly (aged 92 and 89 years) men with complicated advanced gastric cancer. Two or three courses of the

combined therapy safely stopped tumor bleeding, and the initial poor prognoses of a few months of survival seemed to be improved (patient 1, over 32 months; patient 2, 14 months). [67]

Modification of This Question in Light of New Research: Cohort or outcome studies are still needed to prove the efficacy of this multimodal treatment for elderly patients with gastric cancer.

COLORECTAL DISEASE

See *New Frontiers,* pp. 94–96.

Diverticular Disease

See *New Frontiers,* pp. 94–95.

***GenSurg 21 (Levels B and A)*: Nonrandomized or randomized trials comparing appropriate management options for complications of diverticular disease in older patients are needed.**

New Research Addressing This Question: An elderly patient presenting with acute perforated diverticulitis presents a serious challenge, especially in the presence of multiple comorbidities. It is therefore critical to evaluate prognostic factors that can serve as indicators of outcomes following surgical intervention. A retrospective study of 172 patients with perforated diverticulitis admitted over a 19-year period was conducted. Of these, 71 patients were aged 70 years or older. The Mannheim Peritonitis Index Score was found to be useful in predicting mortality in this patient population. The score includes purulent peritonitis (6 points), fecal peritonitis (12 points), age over 50 years (5 points), female gender (5 points), preoperative duration of peritonitis for more than 24 hours (4 points), and organ failure—ie, kidney or lung failure, shock, or intestinal obstruction (7 points). Patients with scores greater than 21 were considered to have a poor prognosis. Although mortality was found to be related to age, age alone was not considered to be an independent predictor. [68]

Patients presenting with acute perforated diverticulitis can undergo either a primary resection and anastomosis or a Hartmann procedure that involves resection of the diseased segment with a proximal end colostomy. [69] Evaluation of postoperative outcomes following Hartmann's reversal showed a higher incidence of prolonged ileus, respiratory infections, and the need for reoperation in comparison with outcomes following a primary resection and anastomosis. There was no difference in the readmission rates or early postoperative mortality. [70]

Alternatively, primary resection and anastomosis with a diverting ileostomy may also be considered. Although a diverting ileostomy may not decrease the incidence of postoperative leak, it can reduce the associated morbidity. In two groups of 20 patients who were studied retrospectively over a 5-year period, complications were found to be more common after Hartmann's reversal than after loop ileostomy reversal. The mean age for the Hartmann's reversal group was 56 years (range 40 to 74) and for the loop ileostomy reversal group was 55 years (range 28 to 76). This finding suggests that segmental colonic excision with anastomosis and loop ileostomy may be an attractive alternative to minimize morbidity with stoma reversal. [71]

Age is a risk factor in acute lower gastrointestinal hemorrhage. Diverticular disease is an important cause. In contrast to elective resection for diverticulosis, emergent management of lower gastrointestinal bleeding can have significant death and complication rates. Preoperative condition and functioning are key predictors of peri-operative complications in the elderly patient. Although the risk of surgical complications increases only slightly with age for elective surgery, it increases dramatically for emergent surgery.[72] Every effort must therefore be made to avoid urgent operations by attending to pre-existing symptoms. These may be neglected in the elderly age group.

A retrospective study of 43 patients older than 80 years with acute lower gastrointestinal hemorrhage revealed that the cause is more likely to be diverticular disease, as opposed to benign ano-rectal and small intestinal pathology in the younger population. Older patients have a higher incidence of comorbidities, such as prior colorectal surgery seen in 9% of patients, or indications for anticoagulant and anti-aggregant medication in 26% of patients. Endoscopy provided a diagnosis in 59% (N = 23) of cases, while arteriography provided a diagnosis in two of the four cases. Urgent surgical intervention was required in 16% of cases. Though conservative management of acute lower gastrointestinal hemorrhage in elderly patients is usually successful, increasing age is associated with high morbidity and mortality, and with relapse of hemorrhage.[73] In patients who present with rebleeding, prolonged observation may be more dangerous than intervention. This and similar studies highlight the role of meticulous peri-operative care in improving overall outcomes in elderly patients.

Modification of This Question in the Light of New Research: Prospective randomized trials are needed to determine the usefulness of early definitive surgery in patients aged 70 years or older who have presented with one or two episodes of acute diverticulitis. Patients in such a study should be divided into groups on the basis of whether they are at low, intermediate, or high risk for any surgical procedure. This will enable identification of patients most likely to benefit from early intervention.

Prospective randomized trials are needed to evaluate outcomes in elderly patients following primary resection and anastomosis in comparison with Hartmann's takedown.

Colorectal Cancer

See *New Frontiers,* pp. 95–96. For new agenda items, see the subsection on colorectal cancer in New Horizons in Geriatric General Surgery at the end of the chapter.

***GenSurg 22 (Level A)*: Randomized controlled trials are needed to compare the various colorectal cancer screening methods now in use for their efficacy in elderly patients.**

New Research Addressing This Question: Two randomized controlled studies have demonstrated decreased mortality from colorectal cancer in asymptomatic patients between the ages of 50 and 80 undergoing yearly fecal occult blood tests.[74] Serial screening endoscopy is particularly advantageous, as it leads to the identification and removal of adenomatous polyps. The progression model for colorectal neoplasia is now well established, and it is now accepted that progression from normal colonic epithelium to adenomatous polyps and finally to infiltrating adenocarcinoma is associated with activation of oncogenes and inactivation of tumor-suppressor genes.

In a cross-sectional study of 15,406 asymptomatic persons aged 50 years or older, 18% were found to have had an inadequate examination. The screening method used was a sigmoidoscopy. In men, inadequate examinations increased from 10% in men aged 50 to 59 years to 22% in those aged 80 and older. In women, the inadequacy was even more marked, with inadequate examinations in 19% of women aged 50 to 59 years and in 32% of women aged 80 and older. [75] Prospective randomized studies are needed to evaluate and compare the adequacy of colonoscopy and sigmoidoscopy in these patient populations so that recommendations can be made with regard to screening protocols.

Full colonoscopy is more advantageous, as polyps can occur exclusively in the proximal colon. It is also more cost-effective if performed once every 10 years, as compared with yearly fecal occult blood testing or more frequent sigmoidoscopies, because compliance with the latter is low. [76]

There are no guidelines for screening and surveillance colonoscopy in the elderly patient. In a study of 1112 patients with an average age of 83.1 years, the diagnostic yield in asymptomatic patients undergoing routine screening and surveillance colonoscopy was low. The procedure could be safely performed, with major complications in only 0.6% of the patients. Indications for the procedure were as follows: polyp surveillance, 227 (19%); altered bowel habits, 168 (14%); iron-deficiency anemia, 132 (11%); and cancer follow-up, 108 (9%). Eighty-six examinations (7%) were performed solely for an indication of colorectal cancer screening; 22% of patients had more than one indication for colonoscopy. The screening group did not have any malignancies. Overall, 45 malignancies were found (3.7%), and 2 malignancies (0.7%) were found in patients undergoing colonoscopy for polyp surveillance. The study concluded that colonoscopy should be limited to elderly patients with symptoms or specific clinical findings. [77]

Modification of This Question in the Light of New Research: Questions that remain to be answered are the determination of the upper age limit after which screening is not beneficial and the efficacy of virtual colonoscopy in the elderly patient in avoiding the 3% risk of perforation that currently exists as a complication of colonoscopy. Research might also be focused on screening that targets elderly individuals with known higher risk for colorectal cancer.

***GenSurg 23 (Level B)*: Exploratory studies are needed to elucidate the roles of emerging technologies in the management of colorectal cancer in elderly patients.**

New Research Addressing This Question: Several studies now confirm that laparoscopic resection for colon cancer is not inferior to open surgery in terms of oncologic outcomes. One randomized multicenter study of patients with a mean age of 70 years showed that recurrence rates at 3 years were the same in both open and laparoscopic groups. Postoperative mortality and morbidity rates were also similar. Length of stay and use of parenteral narcotics were shorter in the laparoscopic group. [78]

Robotic assistance has facilitated laparoscopy by offering magnified, three-dimensional visualization and articulating instruments that better simulate the movements of the human hand. Data on the use of this technology in colon surgery is just beginning to emerge.

Transanal endoscopic microsurgery, which uses specialized instruments to resect rectal tumors, has also recently been introduced. The role for this modality in the treatment of rectal tumors in the elderly patient is not yet defined.

Modification of This Question in Light of New Research: Prospective studies are needed to determine whether newer technologies, such as robotic techniques for low anterior resection or transanal endoscopic microsurgery for rectal tumors, will improve the overall results of surgical treatment of colorectal cancer in older patients.

LIVER RESECTION

See *New Frontiers,* pp. 96–97. For a new agenda item, see also the subsection on liver resection in New Horizons in Geriatric General Surgery at the end of the chapter.

GenSurg 24 (Level B): **Cohort studies are needed to determine the role, safety, and efficacy of newer liver-directed therapies in older patients, for example, cryoablation, radiofrequency ablation, and hepatic artery infusion.**

New Research Addressing This Question: Although several studies have evaluated the role of cryoablation, radiofrequency ablation, and hepatic artery infusion, there are no studies that have evaluated these modalities in the elderly patient.

Modification of This Question in the Light of New Research: The role of these different modalities still needs to be evaluated in elderly patients. This item should remain on the research agenda.

BILIARY DISEASE

See *New Frontiers,* pp. 97–98.

GenSurg 25 (Level A): **Randomized controlled trials are needed to compare the safety and effectiveness for older patients of outpatient or short-stay cholecystectomy with the safety and effectiveness of longer hospital stays.**

New Research Addressing This Question: Elderly patients with gallbladder disease tend to present with complications of cholelithiasis such as acute cholecystitis, choledocholithiasis, or gallstone pancreatitis and require more urgent intervention. Early referral in this group for an elective operation can minimize the morbidity and mortality secondary to complicated gallbladder disease. [79] Cholecystectomy is one of the most commonly performed general surgical procedures in elderly patients. Laparoscopic cholecystectomy continues to be the procedure of choice for the management of gallstone disease. It has been shown that elective laparoscopic cholecystectomy for uncomplicated disease in the elderly age group has comparable safety and efficacy to that seen in younger populations. [80]

A retrospective chart review of 47 patients with a median age of 71 undergoing laparoscopic cholecystectomy was undertaken to evaluate the outcomes of the procedure. The mean postoperative stay for the patients aged 70 years or older was significantly longer than for the younger group, although 30% of the older patients had only a one-night postoperative stay. [81] Patients undergoing surgery for symptomatic cholelithiasis require a shorter postoperative hospital stay than those undergoing surgery for acute cholecystitis or gallstone pancreatitis.

A retrospective review of 70 patients aged 80 or older who underwent cholecystectomy for biliary disease showed that 17 patients presented for elective surgery and 54 presented with complications of cholelithiasis. The conversion rate was 12.5% in the elective group

and 37% in the emergent group. The average length of stay was 3.7 days in those who underwent elective laparoscopic surgery but 11.7 days for patients who underwent emergent laparoscopic surgery. Morbidity and mortality did not differ significantly between laparoscopic and open procedures performed for acute disease.[80] A prospective study evaluated 421 patients aged 65 or older undergoing laparoscopic cholecystectomy. The patients were divided into two groups: those 65 to 79 years old and those 80 to 95 years old. A study database was analyzed. Advanced age was found to be associated with higher mean ASA scores (P = .001) and a higher incidence of choledocholithiasis (P = .01). There was an increased incidence of grade 1 and 2 complications (ie, those requiring either bedside intervention or invasive procedures including surgery) in the older patients (P = .05), probably secondary to increased incidence of inflamed or scarred gallbladder or the presence of choledocholithiasis.[23]

Modification of This Question in the Light of New Research: Randomized controlled trials may be difficult to perform, as the safety and effectiveness of outpatient or short-stay cholecystectomy for the elderly patient has already been established. Therefore, this question can be dropped from the research agenda.

***GenSurg 26 (Level B)*: Basic physiologic and biochemical studies are needed to learn why older patients are more likely than younger patients to present with complicated biliary disease.**

See the discussion of research relating to GenSurg 3 and GenSurg 4.

PANCREATIC DISEASE

See *New Frontiers*, p. 98.

***GenSurg 27 (Level B)*: Cohort or case-control studies are needed to determine what are the most appropriate selection criteria for pancreatic resection in older patients.**

New Research Addressing This Question: Pancreatic cancer is the fourth leading cause of death in both men and women, and each year approximately 28,000 Americans die of the disease. The mean age for local-stage adenocarcinoma of the pancreas in a group of 1331 patients was found to be 71.2 years, indicating that it is an important cause of morbidity and mortality in an aging population.[82] Data extracted from the Surveillance, Epidemiology and End Results (SEER) Program of the National Cancer Institute for the period 1997 to 2001 also revealed an incidence of ~60% of pancreatic cancers diagnosed between ages of 65 and 84.[83] The growth in the older population and the increasing incidence associated with age results in a greater number of elderly patients in need of surgery for management of pancreatic cancer. Although the appropriateness of extensive surgery, such as a pancreatic duodenectomy, in elderly patients has been questioned, several studies have shown that long-term survival after pancreatic resection is similar in elderly and younger patients. Therefore, the decision to proceed with curative pancreatic resection should be made independently of the patient's age, taking into consideration instead factors that can affect long-term outcomes.[84] The rate of cancer-directed surgery has been found to be 26.2% for adenocarcinoma of the pancreas. However, the rate of cancer-directed surgery was significantly lower for patients older than 70 years than in patients 40 to 50 years of age (20% versus 55% to 56%, respectively).[82] This pattern is

probably due to concern that an elderly patient may not be able to tolerate the stress of surgery because of decreased physiologic reserve. A tool such as Comprehensive Geriatric Assessment to define the individual's operative risk would help to optimize the surgical management of elderly patients with resectable pancreatic cancer. [85]

The overall response to surgical resection in pancreatic cancer is still suboptimal, with survival times being less than 12 months. The addition of chemotherapy in these patients has increased the mean survival to about 24 months. Advances in chemotherapy such as those discussed below are possible only in patients with resected disease. Postoperative adjuvant treatment and expected changes in outcomes following such treatment therefore become important factors that should be considered while deciding selection criteria regarding surgical resection for pancreatic cancer in the elderly patient.

The European Study Group for Pancreatic Cancer 1 trial is the largest study of adjuvant treatment. It is a multicenter randomized trial of adjuvant chemoradiotherapy and chemotherapy (5FU) in patients with resected pancreatic cancer. After a median follow-up of 47 months, a highly significant difference in median survival in favor of chemotherapy was reported. The 2- and 5-year survival rates for chemotherapy were 40% and 21%, while the 2- and 5-year survival rates without chemotherapy were 30% and 8%. No benefit was seen in patients who received chemoradiotherapy. [86] Adjuvant chemotherapy has also been shown to be effective in treating pancreatic cancer in a randomized controlled trial in Japan. [87]

A meta-analysis of the randomized adjuvant therapy trials for pancreatic cancer concluded that chemotherapy is more effective than chemoradiotherapy in the treatment of resected pancreatic cancer. Patients younger than 60 years formed 45% of the patient population in these studies, while those 60 years and older formed 55%. Adjuvant chemoradiation did not lead to a significant difference in the risk of death and did not significantly change 2-year and 5-year survival rates in patients with pancreatic cancer. However, a subgroup analysis found that adjuvant chemoradiation was more effective in patients with positive resection margins. [88]

There have been significant advances in imaging, staging, surgical techniques, and peri-operative care of the patient with pancreatic cancer. This has now resulted in operative mortality of $< 5\%$ in high-volume centers. However, the 5-year survival rate of patients diagnosed with pancreatic cancer has not changed from what it has been over the past two decades and is still only a dismal 5%. One of the most recent studies evaluated clinical and demographic factors to test their effect on outcomes of pancreatico-duodenectomy in two groups of patients, one group aged 70 years and older, and the other group younger than 70 years. Significantly higher morbidity and mortality was observed in the older age group (morbidity of 49.1% versus 45.8%, and mortality of 10.5% versus 3.7%). These were attributed to increased comorbidities, reduced functional reserve, decreased tolerance to stress, and the texture of the pancreatic remnant. A soft pancreatic remnant has been found to increase the rate of leak from the pancreatico-jejunal anastomoses. [89] Even though there is no documented correlation between age and the texture of the pancreatic remnant, modification of the procedure in older patients with a soft pancreatic remnant may yield better outcomes. [90]

Pancreatic duct lesions are now thought most likely to be the precursors of infiltrating duct adenocarcinomas. This is associated with multiple genetic alterations that include activating point mutations in the K-ras gene, overexpression of HER-2/neu, and the inac-

tivation of several tumor suppressor genes. [91] Early detection and resection of intraductal pancreatic neoplasms and the use of chemoprevention in patients with intraductal papillary mucinous neoplasms and those at increased inherited susceptibility to pancreatic cancer may be important areas of future research. Additionally, evaluation of genetic alterations in samples of pancreatic secretions may prove to be an important screening tool for patients with increased susceptibility to pancreatic cancer. [92]

Modification of This Question in Light of New Research: Future studies evaluating the use of ligation of the duct of Wirsung or use of temporary fibrin glue for occlusion of the main duct in elderly patients with a soft pancreatic remnant may show a reduced peri-operative morbidity and mortality in this patient population. Future studies to identify genetic markers for susceptibility to pancreatic cancer should be performed to help select the group of older patients who would most benefit from resection for pancreatic duct lesions.

***GenSurg 28 (Level A)*: Exploratory prospective cohort studies are needed to suggest how elderly patients with pancreatic cancer are best palliated.**

New Research Addressing This Question: A retrospective review was conducted of the notes of all patients (mean age 64.5 years) who underwent gastroduodenal stent insertion for malignant gastroduodenal obstruction. The primary tumor was gastric in 20 patients, pancreatico-biliary in 15, and metastatic in 5. A stent was successfully placed in all cases. The researchers conclude that the use of enteral stents achieves good palliation and allows discharge from the hospital and reintroduction of an enteral diet. [93]

Patients with pyloroduodenal obstruction secondary to malignancy generally undergo an open gastrojejunostomy (OGJ) to bypass the obstruction. Other methods now available for palliation include laparoscopic gastrojejunostomy (LGJ) and endoscopic stenting (ES). In one study, 181 patients with malignant pyloroduodenal obstruction, of whom 56 patients had OGJ, 14 had LGJ, and 16 had ES, were evaluated to study differences in outcomes, with particular emphasis on time to starting free oral fluids and light diet, length of stay, and survival. No significant differences in age, sex, ASA grade, and level of obstruction were found between the matched OGJ (n = 16), LGJ (n = 14), and ES (n = 16) groups. Patients who underwent ES were able to tolerate free oral fluids and light diet earlier, and had a decreased length of stay after the procedure than the surgical group, with values showing a significant difference. The incidence of complications was significantly higher in the surgical group than in the stenting group. In spite of the fact that survival was shortest in the ES group, there were significant benefits following ES as compared with OGJ and LGJ. [94] Combined biliary and duodenal stenting for the palliation of pancreatic cancer can also be performed safely and successfully. Stents allowed effective recanalization of the biliary tract and duodenum, relieving both jaundice and vomiting. This procedure should be considered as an alternative to palliative surgery, especially in critically ill patients. [95]

Modification of This Question in Light of New Research: Future studies should be directed at evaluating the proper timing for palliative intervention with reference to use of chemotherapy and chemoradiotherapy in patients with unresectable disease. Randomized prospective trials are indicated in elderly patients with positive resection margins to compare adjuvant chemotherapy and adjuvant chemoradiotherapy. Future studies should evalu-

ate the efficacy of gemcitabine in patients with advanced metastatic adenocarcinoma of the pancreas. Studies also need to be performed with advanced radiation techniques that are now available and can be used without delaying the chemotherapy schedules for these patients.

CEREBROVASCULAR DISEASE

See *New Frontiers,* pp. 99–100.

***GenSurg 29 (Level B, then A)*: Cohort studies followed possibly by randomized controlled trials are needed to determine beyond what age carotid endarterectomy is minimally or not beneficial.**

New Research Addressing This Question: The use of antihypertensive medications, particularly the successful treatment of systolic hypertension, has resulted in the primary prevention of fatal or nonfatal strokes in hypertensive and high-risk patients aged 60 years and older. In addition to antihypertensives, antiplatelet agents are also indicated in elderly patients with nonembolic strokes. Additionally, the use of statins has been shown to prevent strokes in high-risk elderly persons aged up to 82 years. Although surgical intervention with carotid endarterectomy is indicated in carotid artery stenosis of 70% or more and outcomes are even better in elderly than in younger patients, medical treatment is still the first-line treatment in asymptomatic elderly patients with less than 70% stenosis. Thus, prevention of cardiovascular disease should be addressed aggressively in the elderly age group, especially in patients aged 75 and older. [96]

A retrospective review of all primary carotid endarterectomies (CEAs) performed by a single surgeon from 1990 to 2003 for severe symptomatic or asymptomatic carotid disease was conducted. Outcomes in patients younger than 80 years and in those aged 80 years and older were compared. Descriptive demographic data, risk factors, surgical details, peri-operative strokes and deaths, and other complications were recorded, as well as the 30-day stroke risk and death rates. In the period studied, 1260 CEAs were performed in 1099 patients; 1145 were performed in 987 patients younger 80 years, and 115 were performed in 112 patients aged 80 and older. In the younger group, 11 peri-operative strokes occurred in the 1145 procedures (0.8%), and in the older group, no strokes occurred in the 115 procedures. The death rates were 0% for the octogenarians and 0.3% for the younger group. This study demonstrates that patients aged 80 and older can undergo CEA with no more peri-operative risks than younger patients. [97]

Carotid angioplasty and stenting is often the preferred treatment for severe carotid occlusive disease in patients labeled as high risk, including those aged 80 or older. A retrospective review evaluated the records and imaging studies of patients aged 80 years or older who underwent attempted carotid angioplasty and stenting, both with and without distal embolic protection. Study results suggest that elderly patients undergoing this procedure with adjunctive distal embolic protection are at a lower risk of peri-procedure adverse events. The researchers concluded that routine clopidogrel use, smaller hardware profile, careful patient selection, and increased experience of the surgeon probably contributed to these results. [98] Another similar study of carotid endarterectomy showed that peri-operative and postoperative mortality and morbidity as well as the long-term stroke-free rate do not differ significantly in patients 80 years or older and those younger

than 80.[99] More importantly, it suggests that increasing age need not be a barrier to surgery and that the patient can benefit from having the procedure most suited to the pathology.

Surgery for carotid artery occlusive disease can be safely performed under local anesthesia in selected patients aged 75 years and older. One study evaluated 262 carotid operations that were performed under local anesthesia between 1998 and 2004. Of these operations, 34% were carotid reconstructions in 70 patients older than 75 years. Indications for surgery included asymptomatic critical stenosis in 26% of patients, transient ischemic symptoms in 46%, and stroke with persisting neurologic deficit in 25%. Comorbidities included coronary artery disease in 38% and arterial hypertension in 72%. Eighty-four percent were ASA class 3 patients. In spite of this, in-hospital mortality was not significantly different from that of the younger patients.[100]

Patients with carotid artery disease can undergo either CEA or CAS. High-risk patients in need of these procedures are those with multiple comorbidities and those who have undergone previous neck irradiation or previous CEA. One study evaluated 545 high-risk patients who underwent CEA and 148 patients who underwent CAS to compare outcomes following these procedures. The incidence of death, stroke, or myocardial infarction was evaluated during the follow-up, with follow-up times of 18 months for CAS and 23 months for CEA. Significant differences were present in patient age (CAS, 75 ± 11.0 years versus CEA, 71 ± 9 years, $P = .012$), but there were no differences in gender or smoking history. The incidence of per procedural complications did not vary significantly between patients treated with CAS and those treated with CEA. CAS is therefore believed to be similar to CEA in safety and efficacy, even in high-risk patients.[101]

Complete occlusion of the contralateral carotid artery has been thought to increase the risk of CEA. Two groups of patients were evaluated in a retrospective study of 221 CEAs: those with contralateral occlusion and those with contralateral patency. Data regarding preoperative demographic features, indications for surgery, operative techniques, and follow-up results were available for 170 of the 221 procedures performed, with 16 of these patients having complete occlusion. Parameters evaluated did not vary between study groups except for the fact that there was increased use of general anesthesia ($P = .05$) in the group with complete occlusion. There were no deaths, and peri-operative stroke rates were not statistically different between groups (complete occlusion group, 6.3%; contralateral patency group, 2.6%; $P = .39$). Long-term patency and stroke-free survival rates at 5 years exceeded 90% and did not vary significantly between groups. This study therefore suggests that contralateral carotid artery occlusion need not be a contraindication for CEA and does not affect outcomes.[102]

Modification of This Question in Light of New Research: Prospective randomized trials are still needed to evaluate the effects of surgery versus medical therapy on the risk of stroke and long-term outcomes in elderly patients with complete occlusion of the contralateral carotid artery. Further trials are needed to demonstrate the long-term efficacy of carotid angioplasty and stenting in comparison with carotid endarterectomy. Studies are also needed to evaluate the use of cerebral protection devices and self-expanding stents to minimize peri-operative morbidity.

GenSurg 30 (Level B): **Prospective studies are needed to determine the incidence and prevalence of cerebrovascular disease in older patients. As with screening for other conditions, prospective studies**

are needed to evaluate the impact of screening for carotid disease on longevity, quality of life, stroke rate, and financial implications. Cohort studies are needed to determine if there is a subset of older patients (eg, smokers, those with hypertension) who benefit from screening for carotid disease.

New Research Addressing This Question: Stroke is the third leading cause of death and a foremost cause of serious, long-term disability in the United States. Older people are more susceptible to cerebrovascular accidents; however, with educated intervention the incidence of debilitating strokes can be markedly reduced. Several risk factors contribute to the increased incidence of strokes in the elderly age group and to the associated morbidity and mortality. These include hypertension, dyslipidemia, diabetes mellitus, and atrial fibrillation. Institution of appropriate treatment and behavioral modifications such as adherence to a healthy diet, regular exercise, and cessation of cigarette smoking can decrease the incidence of strokes among older adults. Other factors that can affect outcomes following a stroke include early recognition of stroke symptoms, quick access to evaluation and treatment, and an intensive rehabilitation program geared to the needs and capabilities of the elderly patient. [103] Diabetes and obesity are two important modifiable risk factors for stroke. [104] Studies have supported a causal role of inflammation in carotid atherosclerosis and emphasize the importance of gene-gene and gene-environment interactions in this pathogenic pathway. [105]

Patients who are at risk for developing a stroke due to significant narrowing of the internal carotid artery are known to benefit from CEA. Diagnosis of the narrowing of the internal carotid artery is usually made by duplex scanning. In a study of 64 patients, angiography was performed in addition to duplex scanning prior to the decision to proceed with CEA. Of these, 14% did not qualify for CEA on the basis of angiographic findings. In 17% of the patients, the angiographic studies showed details of the distal vasculature that were not evident on duplex scanning, and three of these patients were excluded from surgery because of extensive distal disease. The risk of angiography is low, with only one patient experiencing a transient ischemic attack at the time of angiography. The study shows that there are limitations to using duplex scanning alone and that angiographic evaluation has its merits in helping to determine the appropriate candidate for surgery. [106]

Modification of This Question in Light of New Research: Future studies should identify stroke risk factors and primary and secondary prevention strategies in the context of aging, with special consideration of the identification and management of acute stroke, recovery, and rehabilitation for older adults who survive stroke. There is also the need to evaluate the role of additional noninvasive carotid imaging such as magnetic resonance angiography or computed tomographic angiography in addition to conventional duplex scanning in the assessment of elderly patients with carotid artery disease.

PERIPHERAL OCCLUSIVE DISEASE

See *New Frontiers,* pp. 101–102.

***GenSurg 31 (Level B)*: Cohort studies comparing the results of endovascular therapy, thrombolytic therapy, and interventional vascular radiology in older patients are needed.**

New Research Addressing This Question: In one study angiographic and clinical results of popliteal, infrapopliteal, and multilevel disease treated with percutaneous transluminal angioplasty (PTA) were evaluated retrospectively in 37 patients aged over 80 years with chronic critical leg ischemia. All patients were at high surgical risk; 81.5% had chronic nonhealing wounds, and 37% had multilevel disease. One hundred and two lesions were treated by angioplasty. Angiographic results obtained at the end of the procedure and clinical outcomes at 1-year follow-up were studied. Patency following angioplasty was present in only 14.8% of the patients. However, overall limb salvage was seen in 74% of patients, and symptomatic relief of rest pain was present in 57%. The temporary vascular patency achieved by angioplasty resulted in complete and partial wound healing in 80% of patients. These outcomes justify the use of endovascular interventions in the elderly population with chronic critical leg ischemia. [107]

A prospective database of patients undergoing endovascular treatment for superficial femoral artery disease was maintained to evaluate the consequences of early failure (30 days or less) after endovascular treatment. The database was maintained from 1986 to 2004. Intention-to-treat analysis was performed, and angiograms of the lesion, with run-offs before and after the procedure, were evaluated. Results were standardized to current Transatlantic Intersociety Consensus and Society for Vascular Surgery criteria. A total of 360 patients with an average age of 65 years underwent 441 procedures. There was no mortality within 90 days of the procedure, and the morbidity was 4%. The failure of the endoluminal procedure did not affect the level of amputation or the level of the distal anastomosis of a bypass graft subsequently performed. The study showed that there is no disadvantage to performing an endoluminal procedure and that it is justifiable to offer aggressive endoluminal approaches to superficial femoral artery disease as a first-line therapy in all patients. [108]

Although patients who present with rest pain are offered operative bypass procedures, patients with claudication are not offered operative bypass unless the claudication interferes significantly with their lifestyle or ability to work. The hesitation to offer operative bypass procedures is due to the fact that the procedure is invasive. Endovascular treatment of atherosclerotic disease below the inguinal ligament has been shown to yield good short-term results. The procedure itself has a low morbidity. More important, it does not interfere with the success of surgical alternatives in the future. These advantages make it difficult to deny this intervention to patients with claudication. The option of endovascular treatment for infrainguinal atherosclerotic disease therefore needs to be offered to patients with significant claudication. More important, outcomes following these procedures should be compared with results of nonsurgical interventions and not with results following operative bypass procedures. [109]

Modification of This Question in Light of New Research: Prospective randomized studies are still needed comparing results of endovascular therapy, thrombolytic therapy, and interventional vascular radiology in older patients. This item should remain on the research agenda.

GenSurg 32 (Level B): Cohort studies are needed to determine selection criteria for lower-extremity bypass in older patients.

New Research Addressing This Question: No research addressing this question was found.

Modification of This Question in Light of New Research: This question should remain unchanged on the research agenda.

***GenSurg 33 (Level B)*: Exploratory studies (eg, case series, cohort studies, outcomes studies) are needed to learn how best to improve limb salvage rates in peripheral vascular disease in older patients.**

New Research Addressing This Question: Aggressive arterial reconstruction in patients with critical lower limb ischemia improves the chances of limb salvage and patient survival. In one study, 114 patients who were admitted for assessment of an ischemic leg underwent preoperative angiography and subsequent definitive treatment: either bypass surgery, amputation, or lumbar sympathectomy. Surprisingly, preoperative risk factors, including age, sex, pre-existing diabetes mellitus, presenting symptoms, and ankle systolic pressure, did not have any effect on limb salvage or mortality. Bypass procedures were attempted in 76 limbs, with 61 patients undergoing a femoropopliteal bypass. Peri-operative mortality was 4% in these patients. Graft patency rates were 77.7% at the end of 1 month and 62.5% at the end of 1 year. These results justify attempts at revascularization. [110] Another study of infrainguinal bypass for critical limb ischemia reported that, despite the achievement of the anticipated graft patency and limb salvage results, 25% of patients did not realize wound healing at 1 year of follow-up, 19% had lost ambulatory function, and 5% had lost independent living status. [111]

Alternate modalities have also been found to be effective in treating patients with lower-extremity critical ischemia. Another study reported successful performance of percutaneous transluminal angioplasty in 18 patients with critical ischemia (mean age 72.8 years). The mean stent length was 30.29 mm, and mean stent diameter was 3.23 mm. Mean follow-up was 256 days. The overall 6-month survival rate was 94.4%, and the limb salvage rate was 94%. These results suggest that treatment with sirolimus-eluting stents is effective and safe for patients with critical ischemia. [112]

Modification of This Question in Light of New Research: Studies in elderly patients with critical limb ischemia should address the effect of pursuing an aggressive policy of revascularization on limb salvage and survival rates. Prospective natural history studies are needed to further define the functional outcomes and their predictors after infrainguinal bypass for critical limb ischemia. Treatment with sirolimus-eluting stents can be considered effective and safe for patients with critical ischemia and should be further evaluated in the elderly patient population.

ABDOMINAL AORTIC ANEURYSM

See *New Frontiers*, pp. 102–103.

Outcomes following elective and emergent repair of abdominal aortic aneurysms (AAAs) are significantly different, and this is particularly noticeable in elderly patients with multiple comorbidities. Factors that affect treatment decisions included ASA grade ≥ 4, inoperable malignancy, New York Heart Association class III, $FEV_1 < 35\%$, creatinine > 6.0 mg/dL, and patient and family choice. In one parallel-group observational study, outcomes were evaluated following operative and nonoperative management. Thirty-three percent of the patients were octogenarians. In this patient population, 5-year survival was highest in patients treated electively (83%). Five-year survival was 42% in the nonoperative group and least in those undergoing emergency repair (20%). [113]

***GenSurg 34 (Level B)*: Studies are needed to identify criteria for selecting patients who should be screened for abdominal aortic aneurysm and the screening methods to use.**

New Research Addressing This Question: Ultrasound is the standard imaging tool; if performed by trained personnel, it has a sensitivity and specificity approaching 100% and 96%, respectively, for the detection of infrarenal AAA. The US Preventive Services Task Force has released recommendations for AAA screening. It states that screening benefits patients who have a relatively high risk for dying from an aneurysm; the major risk factors are age 65 years or older, male sex, and smoking at least 100 cigarettes in a lifetime. [114] The guideline recommends one-time screening with ultrasound for AAA in men aged 65 to 75 years who have ever smoked. Patients with abdominal aortic diameter of 3 cm or less do not require further screening. Those with an aneurysm of 3 to 4 cm should be screened every 12 months; those with an aneurysm of 4 to 4.5 cm should be screened every 6 months; and those with an aneurysm larger than 4.5 cm should be referred to a vascular surgeon. No recommendation was made for or against screening in men aged 65 to 75 years who have never smoked, and the task force recommended against screening women. Men with a strong family history of AAA should be counseled about the risks and benefits of screening as they approach 65 years of age. [115]

A study to evaluate the cost-effectiveness of screening for AAAs showed that screening men aged 64 to 73 years is cost-effective. [116] Women are usually not considered for AAA screening because of the lower prevalence of the disease among women. This position may, however, be questioned, given the higher risk of rupture and the longer life expectancy of women. A study evaluating the cost-effectiveness of screening 65-year-old women for AAA showed that the incremental cost-effectiveness ratio is similar to that found for screening men, which reflects the fact that the lower AAA prevalence in women is balanced by a higher rupture rate. Screening women for AAA may be cost-effective, and future evaluations on screening for AAA should include women. [117]

Modification of This Question in Light of New Research: This question has been answered, and GenSurg 34 can be dropped from the research agenda.

***GenSurg 35 (Level A)*: Randomized controlled trials are needed to compare results using newer endovascular repairs in elderly high-risk patients with results in traditional surgical abdominal aortic aneurysm repair.**

New Research Addressing This Question: With the projected increase in the elderly population, an increase in the number of elderly patients presenting with AAA is expected. In addition to conventional open repair of abdominal aneurysms, endoluminal approaches now offer an alternative means of treating these patients. The mortality rates for open repair of AAA vary from 2.7% to 5.8%. No survival benefit is found if the aneurysm is less than 5.5 cm. Elderly patients with cardiac disease, renal insufficiency, and pulmonary insufficiency are at high risk for morbidity and mortality. However, it has been shown in separate studies that if surgery is denied, the mortality from rupture of the AAA is between 35% and 49%, [118] suggesting that factors other than age alone should be taken into account when surgical intervention is considered.

Endovascular aneurysm repair (EVAR) is a new technology to treat patients with AAA when the anatomy is suitable. Uncertainty exists about how endovascular repair compares

with conventional open surgery. The EVAR trial 1 comparing these treatments in patients judged fit for open AAA repair randomized 1082 elective patients to receive either EVAR (n = 543) or open AAA repair (n = 539). Patients aged at least 60 years with aneurysms of diameter 5.5 cm or more who were fit enough for open surgical repair were recruited for the study at 41 British hospitals proficient in the EVAR technique. Patients (983 men, 99 women) had a mean age of 74 years and mean AAA diameter of 6.5 cm. Of the total group studied, 1047 (97%) underwent AAA repair and 1008 (93%) received their allocated treatment. [119] The 30-day mortality rate in the EVAR group was 1.7% (9/531) versus 4.7% (24/516) in the open-repair group. By per-protocol analysis, 30-day mortality for EVAR was 1.6% versus 4.6% for open repair. Secondary interventions were more common in patients allocated to EVAR (9.8% versus 5.8%, $P = .02$). [120] In older patients with suitable anatomy, EVAR can be performed with minimal morbidity and short length of stay. Older patients not suitable for EVAR constitute a higher risk group because of increased incidence of coronary artery disease and the need for more complex repairs. However, the mortality rate in this group was only 4.6%. [121]

In the EVAR trial 2, the authors investigated whether EVAR to exclude AAA in patients considered unfit for open surgical repair improves survival in comparison with no intervention. The randomized controlled trial included 338 patients aged 60 years or older with an aneurysm of at least 5.5 cm in diameter, of whom 166 were to receive EVAR and 172 no intervention. The endpoints were all-cause mortality, aneurysm-rated mortality, postoperative complications, health-related quality of life, and hospital costs. The 30-day operative mortality in the EVAR group was 9%, and the no-intervention group had a rupture rate of 9 per 100 person years. No significant difference in aneurysm-related mortality was found between the two groups; the overall mortality rate after 4 years was 64%. The authors concluded that EVAR has considerable 30-day operative mortality in patients already unfit for open AAA repair and that it does not improve survival over no intervention. [122]

Factors that affect outcomes of both open and endovascular repair of AAA include preoperative cardiac status and renal function. Older patient age is independently associated with a higher risk of major postoperative complications after AAA repair. One study found that increasing age correlates with a higher risk of having one or more complications (ages 51 to 60: 18.8%; 61 to 70: 27.3%; 71 to 80: 31.2%; 80 and older: 34.3%; $P < .01$). Comparison of the oldest and youngest age groups revealed higher rates of the following in the oldest patients: pulmonary insufficiency 13.9% versus 6.4%, pneumonia 7.7% versus 3.0%, reintubation 9.5% versus 3.9%, acute renal failure 8.8% versus 2.5%, myocardial infarction 4.3% versus 1.6%, and mortality 7.9% versus 1.1%. [123]

It is interesting to note that glomerular filtration rate (GFR) can help stratify the risk of peri-operative and long-term mortality in patients undergoing EVAR more accurately than serum creatinine alone. Mortality following EVAR is no doubt affected by the need for contrast agents that are nephrotoxic. Patients with GFR of less than 45 exhibit decreased survival after EVAR. Peri-operative mortality in patients with a GFR of 45 to 60 is similar to that seen in patients with a GFR below 45. However, late survival in patients with a GFR between 45 and 60 is similar to that of patients with a GFR higher than 60. This suggests that the use of alternative, better contrast agents that are less likely to be nephrotoxic or the use of renal protection techniques may improve outcomes after EVAR. [124]

Modification of This Question in Light of New Research: Future studies stratifying patients according to their comorbidities are needed to determine the optimal use of cardiac and renal protective agents during EVAR or open repair of AAA.

PRESSURE ULCERS

See *New Frontiers,* p. 103.

***GenSurg 36 (Level B)*: Cohort studies are needed to suggest whether prevention and treatment strategies for pressure ulcers that are applicable to younger patients are also applicable to older patients.**

New Research Addressing This Question: More than two thirds of all pressure ulcers occur in elderly persons. Although the risk factors for and the incidence of pressure ulcers are well documented in younger patients, few studies have addressed the problem in the older patients. A prospective cohort study was designed to estimate the incidence and identify risk factors for lower-extremity pressure ulcers in older adult patients confined to bed. The study enrolled 259 patients who were aged 65 years or older, confined to bed, and without lower-extremity pressure ulcers at the time of enrollment. Cox regression analysis indicated three factors to be independently related to the risk of new lower-extremity pressure ulcer: low ankle-brachial index value (hazards ratio 0.075; 95% CI, 0.023 to 0.242), length of period of confinement to bed (hazards ratio 1.010; 95% CI, 1.004 to 1.015), and male gender (hazards ratio 2.951; 95% CI, 1.450 to 6.009). [125]

Economic studies have shown that the costs of preventing and treating pressure ulcers approach those of treating cancer and cardiovascular disease. Most of these costs are incurred in lengthy hospital stays and the use of antipressure beds. In addition to improper mattresses, poor seating—often in collapsible wheelchairs or in gerichairs—contributes to pressure ulcer formation. Pressure sores may also develop when the head of the bed is continuously elevated at least 30 degrees (for nasogastric tube feeding or as a precaution against aspiration). [126]

A multicenter retrospective cohort study used medical record abstraction to obtain 2425 patients aged 65 years and older who had been discharged from acute care hospitals after treatment for pneumonia, cerebrovascular disease, or congestive heart failure. Six processes of care for preventing pressure ulcers were evaluated: daily skin assessment, the use of a pressure-reducing device, documentation of the patient's being at risk, repositioning at least every 2 hours, nutritional consultation for patients with nutritional risk factors, and pressure ulcer staging. The associations between processes of care and the incidence of pressure ulcer were determined with Kaplan-Meier survival analyses. Estimates of adherence with each process of care were as follows: daily skin assessment, 94%; use of pressure-reducing device, 7.5%; documentation of risk, 22.6%; repositioning, 66.2%; nutritional consultation, 34.3%; stage 1 pressure ulcer staged, 20.2%; and stage 2 or greater ulcer staged, 30.9%. This study suggests that there still remain numerous opportunities to improve care relating to the prediction and prevention of pressure ulcers in older patients. [127]

Malnutrition plays a critical role in the incidence of pressure ulcers in old age. Studies have shown that improved nutritional status helps prevent the development of pressure ulcers in younger patients. In one study of a 15-day nutritional intervention with two oral supplements of 200 kcal added to a 1800 kcal hospital diet in 672 critically ill older

inpatients, that patients showed a tendency to have fewer pressure ulcers at days 5, 10, and 14. The study also clearly showed the problems in achieving nutritional goals despite offering adequate quantities. [128] Another study evaluated the effect of supplemental tube feeding (1500 kcal, 60 g protein) during nighttime for two groups of inpatients with hip fractures, one group receiving tube-fed supplementation, the control group receiving no supplementation. All patients received a standard hospital diet in the daytime. Despite a low acceptance of the tube, intakes of energy and protein were 2 to 3 times higher and nutritional status was largely improved in the supplemented group, but without any effect on the development and severity of pressure ulcers. [129]

Severe malnutrition, impaired oral intake, and the risk of pressure ulcer formation appear to be interrelated. Energy and nutrients, such as proteins and vitamins B and C, that are deficient in old age are needed in pressure ulcer healing. Attention should be focused on early recognition of a depleted nutritional status in the older patient and on an adequate and supervised intake of energy (35 kcal/kg) and protein (1.5 g/kg), with provision of the recommended daily allowances of micronutrients and correction of the nutrient deficiencies of old age. [130]

Modification of This Question in Light of New Research: Prospective randomized trials are needed to determine the value of indicators enabling early recognition and intervention to prevent the development of pressure ulcers and to compare outcomes between younger and older patients, especially in the postoperative period.

NEW HORIZONS IN GERIATRIC GENERAL SURGERY

THYROID DISEASE

The average age for patients presenting for surgery for multinodal goiter has steadily increased, from 56.6 years in 1995 to 63.2 years in 2003. Although total thyroidectomy has replaced subtotal thyroidectomy as the treatment of choice for multinodal goiter, this has not been validated for the elderly patient. An analysis of 279 patients who underwent total thyroidectomy for multinodal goiter studied differences in outcome secondary to age. The duration of the operation, intraoperative blood loss, the weight of the resected thyroid gland, and the proportion of retrosternal goiter were found to be significantly higher in the group aged 70 years or older. The incidence of surgically related complications, such as recurrent laryngeal nerve palsy and hypoparathyroidism, were similar in young and elderly patients. [131]

Thyroid nodules are clinically detectable in about 4% to 7% of the general population. However, the incidence of subclinical nodules discovered by thyroid ultrasonography exceeds 50% in women aged over 60 years. Though about 5% of clinical thyroid nodules are cancerous, in surgical specimens not previously submitted for cytologic analysis, the incidence may range from 8% to 20%. Thyroid cancers are usually differentiated carcinomas and have a favorable prognosis. However, undifferentiated carcinoma or anaplastic carcinoma accounts for about 2% to 14% of thyroid cancer and has a dismal prognosis. [132] It may arise from longstanding papillary carcinoma and occurs in the elderly population.

Thyroid cancer in the elderly patient has a poor prognosis because of its aggressiveness. The extreme aggressiveness of anaplastic carcinoma makes it impossible to perform the

curative treatment because of direct invasion to trachea and adjacent vital structures. Accordingly, palliative surgery and adjuvant treatment, such as radiation therapy and chemotherapy, could be considered for salvage and quality of life. Thyroid hormone replacement after total thyroidectomy should be undertaken cautiously in the elderly patient to avoid the adverse bone effect (osteoporosis) and cardiac effect (tachycardia, atrial fibrillation, and premature atrial contraction). [133]

Advances in the accurate diagnosis of thyroid tumors may be beneficial in an elderly population. A particular problem is distinguishing between follicular thyroid carcinoma and benign follicular thyroid adenoma. Researchers have found four genes (*DDIT3, ARG2, ITM1,* and *C1orf24*) to differ between the two classes of thyroid tumor and that a linear combination of expression levels distinguishes follicular thyroid carcinoma from follicular thyroid adenoma (estimated predictive accuracy of 0.83). They also found immunohistochemistry for *DDIT3* and *ARG2* to show consistent staining for carcinoma in an independent set of 59 follicular tumors. [134] Tests based on a combination of these markers might improve preoperative diagnosis of thyroid nodules, allowing better treatment decisions and reducing long-term health costs in the elderly age group.

***GenSurg 37 (Level B)*: Observational studies are needed to elucidate the differences between older and younger patients with regard to the biological behavior, diagnostic approach, and invasiveness of thyroid malignant nodules as well as to clarify the differences in the safety of surgical intervention, postoperative quality of life, and adverse consequences of longstanding tumor.**

BREAST CANCER

The use of postmastectomy radiotherapy in elderly women with high-risk breast cancer has been studied recently. The study analyzed 233 women aged 70 years and over with tumors larger than 5 cm or with four or more axillary nodes. Of these women, 147 were treated with radiotherapy and 86 women were treated without it. Although the tumor size distribution and systemic therapy was the same in both groups, a higher number of women who received radiotherapy had four or more positive lymph nodes and positive surgical margins. Elderly women who had radiotherapy had a lower local recurrence rate than those who did not have radiotherapy. There was no difference between the two groups in the incidence of distant recurrence, disease-free survival, or overall survival. [135]

Trastuzumab is a humanized monoclonal antibody used in the treatment of breast cancer. Cancers that overexpress human epidermal growth-factor receptor 2 (HER2) are associated with a poor prognosis and aggressive disease. Trastuzumab has been approved as an additional first-line chemotherapeutic agent in patients with HER2-positive metastatic breast cancer and has been found to improve the time to disease progression, objective response rate, duration of response, and overall survival in randomized multicenter trials. It has also been approved for monotherapy in women with HER2-positive metastatic breast cancer who had already undergone chemotherapy and as a standard component of adjuvant therapy for patients with HER2-positive early-stage breast cancer. [136]

Concern for the ability of the older woman with breast cancer to tolerate the rigors of chemotherapy may lead to undertreatment and higher mortality in these patients. Older women are still under-represented in clinical trials. These factors can be changed by physician education and by trials designed especially for the older woman with breast

cancer. Chemotherapy should be considered for older women with breast cancer who fall into high-risk groups: namely, women with node-positive tumors, those with poorly differentiated tumors even if they are node-negative, and those with hormone receptor–negative tumors. Additionally, if agents such as aromatase inhibitors are more effective than tamoxifen in reducing breast cancer recurrence in postmenopausal women, these agents should be used more widely. [137]

It is critical that elderly patients be included in clinical trials. Older women are as interested in enrollment in clinical trials as younger women. When asked to participate, 56% of younger patients and 50% of older patients chose to participate in clinical trials. [138] However, in the early 1990s, even though 22.8% of newly diagnosed breast cancer patients were aged 75 years or older, only 2.7% of those enrolled in the National Cancer Institute cooperative trials were in this age group. Reasons for this lack of enrollment include the older patients' comorbidities and lower financial and social support. Increasing age has also been found to be associated with deviation from established guidelines. While 6% of patients younger than 65 years did not receive standard treatment, 22.2% of patients aged 65 or older did not receive the treatment. Reasons cited in the younger cohort included prohibitive medical conditions, favorable primary tumor, or patient refusal. No reasons were documented for the older cohort. [139]

A review of tumor biology in two US databases showed that with increasing age, there is a more frequent expression of hormone receptors, lower rates of tumor cell proliferation, greater frequency of diploidy, and lower expression of HER2 and epidermal growth factor. In older women, more tumors express estrogen receptor and progesterone receptors, have lower proliferative rates, are diploid, have normal levels of p53, and do not express epidermal growth-factor receptor or C-erb B_2. [140] Even though these biological characteristics suggest that older women with breast cancer have more indolent disease, this does not translate into the expected clinical outcome, as seen in a study evaluating women with locoregional disease treated with mastectomy without systemic therapy. Women aged 70 years and older had lower distant disease-free survival rates than women aged 40 to 70 years at 10 years, both in node-positive and node-negative groups. [141]

GenSurg 38 (Level A): **Randomized controlled trials are needed to compare rates of recurrence and survival in groups of older breast cancer patients who are treated with postmastectomy radiotherapy and with polychemotherapy.**

GenSurg 39 (Level B): **Observational studies are needed to evaluate the benefit of adjuvant therapy in elderly women presenting with breast cancer with high-risk indicators.**

GenSurg 40 (Level B): **Observational studies are needed to evaluate how age, menopausal status, and estrogen-receptor levels impact benefits from chemotherapy and endocrine therapy.**

GenSurg 41 (Level A): **Prospective randomized trials are needed to study short-term and long-term outcomes following the use of aromatase inhibitors in postmenopausal women, and the incorporation of trastuzumab into adjuvant therapy of women with HER2- or neu-positive breast cancer.**

GASTROESOPHAGEAL REFLUX DISEASE

See *New Frontiers*, pp. 91–92, 93.

The prevalence of GERD has risen in recent years. Some studies report similar prevalence rates for both younger and older people: approximately 20%. [142] Others suggest that the prevalence is higher in the elderly age group. [143] A prospective study of the prevalence of endoscopy-positive GERD showed an incidence of 5.8%, with a higher incidence in men. This study found age to have a minimal effect on prevalence in men but the prevalence rate to rise among women as they age. [144] Elderly persons have also been found to have a higher rate of paraesophageal hernias. [145] In another study, upper gastrointestinal endoscopy was performed on 300 patients who presented for surveillance colonoscopy and had not previously undergone esophagoscopy. Endoscopy revealed that Barrett's esophagus was present in 16.7% of the patients; it was more common in men (21.7%) than in women (10.8%). GERD symptoms were present in 35% of patients. Interestingly, Barrett's esophagus was present in 19.8% of symptomatic and 14.9% of asymptomatic cases; 92% of the patients had Barrett's esophagus of less than 3 cm. [146]

Several factors are responsible for the increased incidence of GERD in the elderly age group. These include changes in esophageal motility and gastric emptying. Other factors are *H. pylori* infection, pill-induced esophagitis, peptic ulcer disease, and complications resulting from use of NSAIDs. [54] The role of *H. pylori* infection in the development of hiatal hernia has been studied. Patients without peptic ulcer disease but with endoscopic evidence of a hiatal hernia were divided into three age groups: those aged 45 years or younger, those aged 46 to 60 years, and those aged 61 years or older. Aging was found to be associated with a higher incidence of hiatal hernias and also an increased incidence of *H. pylori* and corpus-based gastritis. However, there was a 46.8% decrease in GERD symptoms in the oldest patient population (compared with 66.6% and 52.1%). This could be due to the blunting of symptoms of GERD seen with aging. However, *H. pylori* infection was found to be higher in patients without GERD than with GERD (66.4% versus 57.3%, $P < .05$) and higher in patients with nonerosive GERD than with erosive GERD (62.8% versus 48.6%). [147]

Although there are data suggesting decreased salivation with aging, acid clearance is as effective in older adults as in younger adults. [148] The length of upper esophageal sphincter high-pressure zone in the elderly person is significantly less than in young person, as is the upper esophageal sphincter resting pressure. No significant difference between elderly and young persons was found in the same parameters evaluated for the lower esophageal sphincter. [149] The prevalence of hiatal hernia, gastric mucosal atrophy, and reflux esophagitis was studied in a 2788 patients over a 3-year period. Gastric mucosal atrophy was divided into two groups: closed and open. The atrophic border is the boundary between the pyloric and fundic gland territories. Endoscopically, this is recognized by evaluating the color and height of the gastric mucosa. In patients with open gastric mucosal atrophy, the atrophy boundary is in the lateral wall or along the greater curvature; in the closed type, the atrophic border is along the lesser curvature or the antrum. The prevalence of reflux gastritis and hiatal hernia was found to increase with age in women but not in men. [150]

The frequency of complications of GERD is higher in elderly patients. This may be due to differences in symptom thresholds for young and elderly patients. Elderly patients present with more advanced disease and with significant mucosal damage. Older patients

with GERD may not present with typical symptoms of heartburn and regurgitation. Instead, they may present with dysphagia, weight loss, vomiting, and anemia. GERD may remain undiagnosed in this patient population. [151] They may also present with atypical symptoms, such as a chronic cough, sleep apnea syndrome, or exacerbation of asthma. [152] Laxity of the esophageal sphincter in older patients makes them more liable to aspiration, especially when they are obese or have a feeding tube. Exacerbation of asthma and chronic obstructive pulmonary disease in the elderly patient are often secondary to chronic aspiration. Once GERD is detected, therapeutic interventions aimed at correction are likely to reduce morbidity and medical expenditure in these patients. [153]

Once esophagitis is diagnosed endoscopically, proton-pump inhibitors relieve symptoms faster than H_2-receptor antagonists. One double blind, randomized, controlled trial found that after resolution of acute esophagitis, treating elderly patients with pantoprazole results in fewer relapses than placebo. [154] Discontinuation of medical therapy for longer than 6 months was found to be responsible for a significant increase in the relapse rate. [155] Another study evaluated the prokinetic and salivary stimulating effects of cisapride in 15 younger and 15 older adults. Both cisapride as well as peppermint lozenges were found to decrease the number of swallows taken to clear the acid infused into the distal esophageal and to return pH to 4. [148] Further studies are needed to evaluate the effect of various drugs such as (5-HT) 4-receptor agonists in the treatment of GERD. [156] Endoscopy should be performed more expeditiously when elderly patients present with symptoms of reflux [143] and medical therapy instituted. Failure to respond to medical management should prompt a surgical referral for an elective antireflux procedure.

Studies have shown that elderly patients have equivalent postoperative results without an increase in postoperative complications following laparoscopic antireflux procedures. [157] In one study, the mean hospital stay following a laparoscopic antireflux procedure was found to be 2.2 ± 1 day in a group of 30 octogenarians and nonagenarians; there was one conversion to a laparotomy, two complications, and no deaths. [145] A retrospective review of 304 consecutive patients who underwent laparoscopic fundoplication for GERD was carried out; 63 of the patients were aged 65 years or older. The older patients more often had regurgitation and respiratory symptoms in addition to heartburn. Hiatal hernias were more common among elderly patients (77% versus 51%). The younger and older groups otherwise proved to be similar in key respects: duration of surgery, a low incidence of intraoperative or postoperative complications, a median hospital stay of 24 hours, and resolution of heartburn in approximately 90% of the patients. The authors therefore concluded that laparoscopic antireflux surgery is as safe in elderly patients as in younger patients and that clinical outcomes are as good. [158]

Surgical intervention has always been indicated for older patients with severe GERD, especially for those who had become refractory to medical management. The advent of laparoscopic antireflux procedure helped to dissipate the hesitation in offering surgery to older patients, probably because it is a minimally invasive procedure. A study comparing outcomes following laparoscopic Nissen fundoplications in 108 patients aged 70 and older with 108 concurrent patients younger than 60 years at similar durations of follow-up found reflux and dysphagia scores to be significantly improved for both older and younger patients. After fundoplication, older patients had lower dysphagia scores and lower reflux scores. A larger number of patients aged 70 or older (91%) as opposed to patients younger than 60 (84%) said that they would undergo laparoscopic Nissen fundoplication again, if

necessary. The study concluded that laparoscopic fundoplication safely ameliorates symptoms of GERD in elderly patients, with symptomatic outcomes superior to those seen in younger patients. [159]

Recently, newer minimally invasive methods for the treatment of GERD have begun to appear. Several types of endoscopic therapy are presently under investigation. Whether these techniques will provide additional options for the treatment of GERD in older patients remains to be determined. [160]

***GenSurg 42 (Level A)*: Randomized prospective studies are needed to compare short-term and long-term outcomes of transendoscopic plication with laparoscopic Nissen fundoplication in elderly patients.**

ACHALASIA

The incidence of achalasia has been increasing over the past decade and may be due to increased incidence of evaluation with esophageal manometry. In one study, 28 consecutive patients were evaluated before and after laparoscopic Heller-Dor myotomy. A gastrointestinal quality-of-life index was used, and a minimum follow-up of 1 year was obtained. Patients were stratified by age: those under 70 years and those 70 years or older. Gastrointestinal symptoms and physical, social, and emotional function were found to be significantly improved in both groups. It was determined, therefore, that the medium-term outcomes of this procedure are not affected by age. [161]

***GenSurg 43 (Level B)*: Observational studies are needed to evaluate the efficacy of surgical management of achalasia in the elderly patient.**

COLORECTAL CANCER

In one study, 100 patients undergoing surgery for colorectal cancer were screened preoperatively for circulating levels of interleukin (IL)-1β, IL-6, and IL-1 receptor antagonist. Low preoperative levels of IL-1 receptor antagonist were found to be associated with increased incidence of postoperative infection ($P = .0001$). This finding was observed in elderly patients ($P < .05$) with low body mass index. These findings explain the increased risk of infection in the elderly malnourished patient, possibly as a consequence of a defective adaptive immune system. [162]

Anastomotic leakage following surgery for colorectal cancer is an important cause of increased morbidity and mortality. A prospective study of patients undergoing elective colorectal resection performed by a single surgeon at a university hospital over a 3.5-year period sought to identify risk factors for anastomotic leakage. Preoperative steroid use, longer duration of surgery, and contamination of the operative field were found to be independent risk factors for increased incidence of leakage. Importantly, age did not affect the incidence of anastomotic leakage; the incidence of leakage was 4%, 2.3%, and 2.3% in patients aged 60 years or younger, 61 to 70 years, and over 70 years ($P = .610$). The study also revealed that a diverting ostomy did not affect the incidence of leakage from the distal anastomotic site. [163]

A retrospective cohort study of 533 patients who over an 8-year period underwent stomal closure was conducted. Univariate analysis showed increasing age to be the only predictor for mortality in patients with stomal closure. Median age of the survivors was 56

years (range 43 to 68); that of nonsurvivors was 61 years (55 to 75), $P = .02$. Sex, type of ostomy, and primary cause were not found to affect mortality rates. [164]

A study of clinical and pathologic parameters comparing rectal cancer patients younger than 65 years with those 65 years or older was carried out in 177 patients accepted consecutively from 1991 to 2002. In the two age groups, postoperative mortality and morbidity were not significantly different. The duration of surgical procedures and the incidence of postoperative complications were variables that were independently associated with 30-day mortality. Patients aged 65 or older demonstrated a significantly worse overall survival ($P = .003$), cancer-specific survival ($P = .02$), and disease-free survival ($P = .03$). In addition to several other factors considered in a multivariate analysis, age of 65 years or older was found to be a risk factor for both overall survival and disease-free interval. While short-term prognosis for elective rectal cancer procedure in patients 65 years or older was similar to that of younger patients, long-term cancer-related survival was found to be statistically lower in older patients. [165]

Researchers have shown that preoperative chemoradiation in elderly rectal cancer patients is feasible and helps to downstage the tumor. A study of 28 rectal cancer patients aged 70 years and older who were treated preoperatively with radiotherapy and 5FU concomitant chemotherapy found no evidence of acute gastrointestinal toxicity, and all the patients underwent surgery without severe peri-operative complications. Complete pathologic response to pT0 (ie, no residual tumor detected in resected specimen by pathologic microscopic examination) was found in 3 patients (11%). Overall T downstaging occurred in 61%. Mean follow-up was 34 months (range 4 to 84). Kaplan Meier Overall Survival at 5 years was 74% (95% CI 54 to 95) and the Disease Free Survival results at 5 years was 65% (95% CI 38 to 93). No treatment-related death was observed. [166]

Treatment of locally advanced or recurrent rectal cancer in elderly patients aged 75 years or older was evaluated in one study of 86 consecutive patients undergoing elective surgery after irradiation with 46–50 Gy for either primary locally advanced rectal cancer (n = 51) or recurrent rectal cancer (n = 35). As seen in younger patients, the study concluded that thorough preoperative evaluation and well-planned and well-executed surgery are critical in achieving potentially curative results in patients with acceptable morbidity. Five-year survival was estimated to be 29% for locally advanced primary cancer without metastases and 32% for locally recurrent rectal cancer. Estimated 5-year local recurrence rates were not significantly different in R0 resections and R1 resections ($P = .434$ ns) and for locally advanced and recurrent rectal cancer ($P = .248$ ns), respectively. [167]

GenSurg 44 (Level A): **Prospective randomized trials are needed to evaluate the best management strategies for colorectal cancer in elderly patients.**

GenSurg 45 (Level B): **Observational studies are warranted to evaluate the effect of various factors, including tumor grading, preoperative carcinoembryonic antigen level, and gender, on cancer-free survival and overall survival in elderly patients with colorectal cancer.**

GenSurg 46 (Level A): **Prospective randomized trials are needed to compare short-term and long-term outcomes in elderly patients who**

undergo total mesorectal excision as opposed to those who undergo transanal excision with adjuvant therapy.

LIVER RESECTION

Liver resection is indicated for colorectal metastases, hepatocellular carcinoma, gallbladder cancer, and hilar bile duct cancer. [84,168]

Hepatic resection is a standard treatment for patients with hepatic metastases secondary to colorectal carcinoma. Colorectal cancer is the third most common cause of cancer deaths worldwide, and approximately 50% to 60% of these patients have hepatic metastases. Several groups have demonstrated that hepatic resection for colorectal metastases is safe and feasible for patients aged 70 years and older. Mortality and morbidity rates have been found to be comparable among younger (< 70 years) and elderly (70 and older) patients. [168,169] A retrospective chart review of 212 consecutive patients with colorectal cancer who underwent potentially curative resection of hepatic metastases between 1992 and 2004 was carried out; 62 patients were 70 years or older and 150 patients were younger than 70 at the time of surgery. There was no significant difference in the rate of postoperative complications or mortality following surgery between the young and older patients. Survival rates in younger patients at 1, 3, and 5 years were significantly better than in the older patients. However, in the older group, survival rates of 79.4%, 46.55%, and 34.1% at 1, 3 and 5 years suggest that age need not be considered a contraindication for hepatic resection. [170] These studies prove that hepatic resection for colorectal metastases is a safe option in elderly patients, provided comorbidities are addressed as they would be in younger patients.

Resection of colorectal liver metastasis involves an anatomic or nonanatomic resection with a 1-cm margin around the tumor. Little is known about the significance of portal vein invasion by colorectal liver metastases; once it is diagnosed, an anatomic major hepatic resection may be necessary for potential curative treatment. [171]

Hepatocellular carcinoma is the fourth most common cause of cancer deaths worldwide, with the peak incidence occurring in the sixth decade of life; 76% of these cases occur in Asia. Mortality rates following hepatic resection for hepatocellular carcinoma are below 10% and do not significantly differ between young and elderly patients. Some groups have reported significantly lower blood loss [172] and lower complication rates in elderly patients. [173] Long-term outcomes have been found to be comparable between young and elderly patients.

Hepatic resection is commonly performed in the United States for resection of metastatic disease and primary hepatocellular malignancies. The prognosis for elderly patients after hepatic resection for hepatocellular carcinoma has been found to be less favorable than that for younger patients, and cirrhosis was found to lead not only to poor survival but also to high mortality in the elderly age group. [174] Hepatic resection in aged patients may have a superimposed surgical risk. An observational study using a nationally representative database showed that in high-volume hospitals and patients older than 65 years, hepatic lobectomy (versus wedge resection), primary hepatic malignancy (versus metastases), and the severity of underlying liver disease were independent risk factors for in-hospital mortality. With regard to age, using a dichotomous age variable with a cut-off point of 65 years, researchers found that patients aged 65 years and older had a 7.8%

in-hospital mortality rate that was significantly greater than the mortality rate of 4.7% for younger patients ($P = .003$). [175]

A retrospective study of 193 patients undergoing hepatic resection showed that elderly patients can undergo the procedure as safely as the control group (younger than 75 years) as long as a careful selection of the patient is performed. Patients excluded were cirrhotic patients with Child-Pugh class B and C, Child-Pugh class A requiring resection of more than two hepatic sectors (trisegmentectomy or extended hepatectomy), patients with thrombosis involving the portal vein trunk or one of the two major branches, noncirrhotic patients with primary disease involving both primary portobiliary branches or the retrohepatic inferior vena cava or the three major hepatic veins. Age was not considered as an isolated exclusion criterion. Importantly, concomitant diseases were found to be more common in the patients older than 75 years, with a statistically significant difference (62.5% of the older group versus 32.9% of the control group, $P = .002$). [176]

***GenSurg 47 (Level B)*: Cohort studies are needed to determine the efficacy of hepatic resection for colorectal metastases and hepatocellular carcinoma in elderly patients**

SEPSIS

The problem of sepsis is of critical importance in the elderly patient. Incidence rates in the United States for severe sepsis rise sharply with age, from 0.2 cases per 1000 among children aged 5 to 14 years to 26.2 cases per 1000 among elderly adults aged 85 years or older. Sepsis develops in 750,000 people annually, and more than 210,000 of them die. [177,178] It is predicted that the incidence of sepsis will increase by 1.5% per year, resulting in 934,000 cases in the United States in the year 2010 and 1,110,000 cases in 2020. Most of this rise can be attributed to the high incidence of sepsis in the elderly age group and the overall aging of the US population. Mortality from sepsis also increases with increasing age, rising from 10% among children to 38.4% among those aged 85 years or older. Sepsis is the leading cause of death in critically ill patients in the United States. [179] The total annual cost for severe sepsis is estimated to be $16.7 billion. Because sepsis affects the elderly age group disproportionately, more than half of all annual costs—$8.7 billion—is spent on the care of patients aged 65 years or older. Sepsis has been commonly defined as an "uncontrolled inflammatory response." Multiple trials targeted at reducing this inflammatory response have proven unsuccessful. [180–182] More importantly, several patients with sepsis have demonstrated immunosuppression with loss of delayed-type hypersensitivity and an inability to clear the inciting infection. [183] This suggests that in established sepsis, there may be a shift toward an anti-inflammatory or immunosuppressive state. This deactivation of leucocytes from septic patients resembles the phenomenon of endotoxin tolerance. Endotoxin tolerance is defined as a reduced capacity of the host to respond to lipopolysaccharide following a first exposure to this stimulus. Although it may be an adaptive response that tends to limit inflammation during a bacterial infection, it may also favor subsequent infections in survivors of septic shock.

Between 42% and 52% of intensive care unit admissions involve patients aged 65 years or older. These patients also account for approximately 60% of all intensive care unit days. This is because elderly patients have multiple comorbidities, including decreased cardiopulmonary and renal reserve, making them more prone to developing progressive organ failure. Elderly intensive care unit patients are also at a higher risk of developing

delirium, another factor that is associated with significant morbidity. Severity of illness and age are the important factors determining intensive care unit survival. It is therefore critical to look for indicators that might dictate the need for more intensive postoperative care in elderly patients undergoing emergent and elective surgery and to continue to maintain a high index of suspicion in the peri-operative period. Our aging society dictates that we must have strict guidelines to optimize care of the older adult who develops critical illness. [184] One study identified several independent predictors of surgical site infection in older people, including comorbid conditions (chronic obstructive pulmonary disease and obesity), peri-operative variables (wound class), and socioeconomic factors (private insurance, which was associated with lower risk). [185]

***GenSurg 48*: *(Level B)*: Observational studies are needed to evaluate the physiologic effect of aging on risk factors for sepsis.**

***GenSurg 49 (Level B)*: Observational and interventional studies are needed to help design and implement interventions to prevent surgical site infections in high-risk older patients.**

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