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GERIATRIC GENERAL THORACIC SURGERY

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General thoracic surgery is a relatively complex surgical discipline in which outcomes have been closely associated with the experience of the hospital [1] and the surgeon. [2] Treatment guidelines and systems of care have been scrutinized and improved in order to optimize the outcome for all patients, particularly those with the highest surgical risk. [3] In addition to the development of and adherence to evidence-based guidelines, better understanding of the molecular biological aspects of thoracic malignancies will improve the outcomes for the many elderly patients who undergo general thoracic surgery.

The Key Questions in geriatric general thoracic surgery from *New Frontiers in Geriatrics Research* [4] are unchanged:

***ThoracicSurg KQ1*: How effective is preoperative preparation in improving the immediate surgical outcome for elderly patients?**

***ThoracicSurg KQ2*: What changes in perioperative care are needed to improve outcomes in the elderly thoracic surgical patient?**

***ThoracicSurg KQ3*: To what extent do thoracic surgical operations improve quality-of-life outcomes in the elderly patient population?**

In this update of the research agenda for general thoracic surgery in older adults, new research addressing agenda items proposed in *New Frontiers* is discussed in the section Progress in Geriatric General Thoracic Surgery. Suggestions for new agenda items in the field are presented in New Horizons in Geriatric General Thoracic Surgery at the end of the chapter.

METHODS

The search was conducted on the National Library of Medicine's PubMed database. In the previous review by LoCicero and Yee, [4] the time period covered was from January 1982 to October 2002. The current search was from October 2002 to December 2005. The search strategy combined various terms for general thoracic surgical procedures (general or specific commonly performed operations, including the esophagus, lung, and mediastinum), the terms *elective* and *emergency*, and various terms for perioperative care, complications, and outcomes. Additional requirements were either that the publication be a review, clinical trial, randomized controlled trial, or meta-analysis, and that terms for risk or age factors be present as title words or MeSH headings. Terms denoting advanced age were *age factors, age, aging, elderly, geriatric, gerontologic, older, or octogenarian, nonagenarian*, or *centenarian*. Finally, animal research was systematically excluded.

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PROGRESS IN GERIATRIC GENERAL THORACIC SURGERY

LUNG CANCER

See *New Frontiers,* pp. 112–121.

ThoracicSurg 1 (Level A): **Randomized controlled trials are needed of the effect on mortality and morbidity of the use of computed tomography screening for elderly patients with high-risk factors for the development of cancer.**

New Research Addressing This Question: The high mortality rate of lung cancer, existence of a recognizable preclinical stage of disease, and efficacy of surgical therapy for early-stage disease of lung cancer has suggested the potential for decreasing lung cancer mortality by the employment of screening strategies. To date, the role of screening for lung cancer has been considered investigational, and several current trials involving spiral computed tomography (CT) scanning have been designed to evaluate the clinical efficacy and cost-effectiveness of this strategy. The Early Lung Cancer Action Project performed yearly low-dose spiral CT scans and chest x-ray in a single-arm study of 1000 smokers. One to six noncalcified lung nodules were found at baseline (ie, prevalence) in 233 participants, 27 (12% or 2.7% of the total screened population) of which had a malignancy. Among these 27 nodules with malignancy, 20 (74%) were not found on standard chest x-ray, while no malignant nodules were detected by chest x-ray that were not also seen on CT scan. The majority (23 of 27, 85%) of malignancies were stage I, and all but one (97%) were resectable. [5]

Subsequently, the group published follow-up on the patients who had a new stage I lung cancer discovered as a result of the study. Screening resulted in a diagnosis of lung cancer in 484 participants. Of these participants, 412 (85%) had clinical stage I lung cancer, and the estimated 10-year survival rate was 88% in this subgroup (95% confidence interval [CI], 84 to 91). Among the 302 participants with clinical stage I cancer who underwent surgical resection within 1 month after diagnosis, the survival rate was 92% (95% CI, 88 to 95). The 8 participants with clinical stage I cancer who did not receive treatment died within 5 years after diagnosis. [6]

Randomized studies of low-dose spiral CT scan screening are under way at other centers in North America and Europe.

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

ThoracicSurg 2 (Level B): **An instrument to assess age-specific outcomes, functional status, and quality of life for elderly lung cancer patients that is applicable to both preoperative and postoperative situations needs to be developed and validated.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

ThoracicSurg 3 (Level A): **Ongoing large therapeutic lung cancer trials need to incorporate the age-specific instrument described in ThoracicSurg 2.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

ThoracicSurg 4 (Level B): **A preoperative tool to assess the general function of the elderly patient having a major pulmonary procedure needs to be developed and validated.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

ThoracicSurg 5 (Level B): **A multivariate analysis using the Society of Thoracic Surgeons Database or other collections of cases and aimed at defining the most important risk factors for adverse surgical outcomes should be performed. The instrument should include measures of the patient's functional capacity as well as pulmonary functions.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

ThoracicSurg 6 (Level B): **A method of preoperative optimization that addresses the most important risk factors for morbidity and mortality from pneumonectomy should be developed and tested.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

ThoracicSurg 7 (Level A): **Randomized controlled trials are needed to compare the efficacy of preoperative optimization methods with current best medical practices.**

New Research Addressing This Question: For patients with T2 or T3 tumors or with mediastinal adenopathy on chest CT or positron-emission tomography (PET), cervical mediastinoscopy is recommended prior to exploration for pulmonary resection. [3,7] Reliance on the CT or PET scan alone for this group of patients is unacceptably inaccurate. [8,9] In a recent multi-institutional study (American College of Surgeons Oncology Group Z0050 trial), the utility of PET in staging potentially operable non–small cell lung cancer patients was assessed in 287 patients (22 institutions). In the assessment of mediastinal lymph nodes, the sensitivity was only 61%, specificity 84%, positive predictive value 56%, and negative predictive value 87%. [9] Thus, PET may be used to direct biopsies, but mediastinoscopy is required to confirm or exclude mediastinal lymph node involvement in patients with potentially operable lung cancer.

The power of large databases used to derive the staging system in predicting prognosis is self-evident. Nevertheless, there is an inherent inaccuracy of this staging process that is attributable to the presence of undetectable metastatic disease at presentation. Molecular biological staging refers to the assessment tumor markers associated with various oncogenic mechanisms in order to improve the risk stratification provided by conventional tumor, nodes, and metastasis (TNM) staging. Biological staging may target oncogenes, oncogenic protein products, growth factors, or receptors. The biological techniques that are utilized include analysis of DNA, RNA, or protein products. Molecular biological staging may potentially be applied to the primary tumor, lymph nodes, bone marrow, or serum in order to establish the diagnosis of malignancy at earlier stage, to assess prognosis, to detect occult metastases, to select therapy, and to predict chemotherapy sensitivity or resistance. [10]

Characterization of the primary tumor may be made using various molecular markers. Trials of biological parameters that may be used to select patients who would most benefit from surgical therapy and to predict whether patients respond to chemotherapy are currently being conducted. [11]

The treatment of non–small cell lung cancer is based on the stage of disease, as determined by the TNM staging system. [3] In general, surgical resection is the standard treatment of patients with stage I disease, and surgery with postoperative chemotherapy is used for stage II disease. Determination of operability must include assessment of the medical risk of thoracotomy as well as the risk of removal of the requisite pulmonary parenchyma. The degree of cardiopulmonary disease, usually a consequence of tobacco use, represents the most significant medical factor in determining operability and the major cause of postoperative morbidity and mortality. Contraindications to surgical resection include pulmonary insufficiency and untreated cardiovascular or cerebrovascular disease. Age is not considered a contraindication, and surgery is considered a viable option in patients with good performance status and reasonable chance for cure into the 9th and 10th decades of life. Sullivan et al assessed 140 patients who underwent lobectomy for non–small cell lung cancer at a Veterans Affairs Medical Center to compare the effect of lobectomy in elderly patients (aged 70 and older) and younger patients (younger than 70 years) on pulmonary function, as measured by forced expiratory volume at 1 second (FEV_1), and functional status, as measured by Karnofsky Status (KS), 1 year following surgery. FEV_1 decreased by 19% in elderly patients and by 13% in younger patients. Functional status declined for two older patients (8%), whose KS dropped from 80%–100% (normal activity without limitation) to 40%–70% (unable to work, but able to take care of self at home). Nine of

the younger patients (24%) had a KS drop from 80%–100% to 40%–70%. Thus, elderly patients undergoing lobectomy for non–small cell lung cancer had similar pulmonary function test results and functional status as younger patients 1 year after undergoing surgery, and curative resection should not be denied on the basis of age alone. [12] In another study, the outcomes of 40 consecutive patients (aged 80 to 88 years) with non–small cell lung cancer who underwent complete resection were analyzed. There was no perioperative mortality, and patients had nonlethal complications (20%). The actuarial survival rates of the 40 patients, including deaths from all causes, were 92.4%, 71.6%, and 56.9% at 1, 3, and 5 years, respectively. In patients with stage I disease, the respective survival rates were 94.3%, 74.3%, and 57.3%. [13] A retrospective study of 1114 patients with lung cancer classified patients as younger ($<$ 75 years) and elderly (75 years and older). Regarding treatment, 51.0% of those in the younger group and 36.1% of those in the elderly group underwent surgery. The perioperative mortality rates for the younger and elderly groups were 0.9% and 4.1%, respectively, with no significant difference, and the overall survival was similar in the two groups. [14] Despite these data, it is clear that age may inappropriately influence treatment selection. In a study from the Netherlands, de Rijke et al asked whether age, comorbidity, performance status, or pulmonary function influenced treatment in patients with newly diagnosed non–small cell lung cancer (N = 803). In this series, 82% with stage I or II disease and 48% with stage IIIA disease received treatment according to the guidelines. For all stages, this proportion decreased with increasing age. Multivariate analyses showed associations between comorbidity and treatment choice, but none with performance status. Age of 75 years or older appeared to be the most important factor for not receiving treatment according to guidelines. [15]

Although chemotherapy has clearly been demonstrated to improve survival for patients with stage III and stage IV non–small cell lung cancer, its efficacy and use in patients with early-stage disease has been controversial. A meta-analysis suggests that cisplatin-based regimens could improve 5-year survival by approximately 5%, but that there is no survival advantage for regimens without platinum. [16] The International Adjuvant Lung Cancer Trial Collaborative Group enrolled 1867 patients with completely resected stage I, II, or III non–small cell lung cancer. In this study, the use of adjuvant chemotherapy was associated with significantly improved overall and disease-free survival: the 5-year overall survival was 44.5% in the adjuvant chemotherapy group and 40.4% in the control group—an absolute benefit of 4.1% ($P < .03$). [17] In a study conducted by the Cancer and Leukemia Group B, 344 patients with completely resected stage IB (T2N0) non–small cell lung cancer were randomized to treatment with paclitaxel and carboplatin or observation. After 4 years of follow-up, overall survival was 71% in the adjuvant treatment group and 59% in the observation group ($P = .028$), a 12% absolute improvement and 49% relative improvement. Failure-free survival and lung cancer mortality were also significantly improved in the adjuvant chemotherapy group. The therapy was well tolerated, with no toxicity-related deaths and grade 3–4 neutropenia in only 36% of patients. [18] Finally, in a study conducted by the National Cancer Institute of Canada, 482 patients with completely resected stage IB (T2N0) or II (T1-2N0) non–small cell lung cancer were randomized to adjuvant treatment with vinorelbine and cisplatin or follow-up alone. Overall survival was found to be significantly prolonged in the adjuvant treatment group (94 months versus 73 months; $P = .011$). These results translated to a 5-year survival rate of 69% with adjuvant treatment compared with 54% for the control group. [19]

The selection of patients to proceed to surgery after preoperative therapy is also important. For patients with stage III disease, it has been demonstrated that nodal downstaging is strongly associated with survival. Betticher et al, for example, examined the effects of preoperative docetaxel and cisplatin in patients with stage IIIA non–small cell lung cancer. In this small study, 90 patients were treated with docetaxel and cisplatin before surgical resection; 33 patients also received adjuvant radiotherapy. Mediastinal downstaging (N0, N1 versus N2) was the most powerful predictive factor for survival. [20]

Modification of This Question in Light of New Research: This question should remain unmodified on the research agenda. However, over the previous two decades, a large amount of clinical experience has been gained regarding the use of induction therapy for non–small cell lung cancer. There are several controversial issues that should be addressed in clinical trials:

- The selection of patients for resection after induction therapy
- The use of induction chemotherapy versus chemoradiotherapy
- The use of induction chemotherapy for early-stage disease
- The use of induction therapy as opposed to adjuvant therapy

ThoracicSurg 8 (Level A): **Randomized controlled trials are needed to evaluate video-assisted thoracic surgery techniques for lobectomy; the trials should compare outcomes, including long-term survival in elderly patients, with those of standard open procedures.**

New Research Addressing This Question: Thoracoscopic lobectomy has emerged as a viable strategy for resection in patients with non–small cell lung cancer. Advantages of a thoracoscopic approach to anatomic lung resection include decreased blood loss, less postoperative pain, shorter length of stay, more rapid return to preoperative activity, preserved postoperative pulmonary function, fewer overall complications, and decreased inflammatory response (which may confer superior immunologic function). These benefits are achieved with equivalent oncologic effectiveness. [21,22]

Thoracoscopic lobectomy has also been found to be safe and effective in selected patients after induction chemotherapy, with or without radiation therapy. [23] Current areas of interest include the investigation of the potential immunoprotective effects of minimally invasive lobectomy and the advantages regarding the delivery of postoperative chemotherapy in patients after thoracoscopic lobectomy. A registry trial is planned to compare the overall effectiveness, including survival and quality of life, between thoracoscopic lobectomy and conventional lobectomy (thoracotomy).

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

BENIGN DISEASES OF THE LUNGS

See *New Frontiers,* pp. 122–123.

ThoracicSurg 9: **(*Levels B, A*): The effects of lung volume reduction procedures and their complications on elderly patients with chronic obstructive pulmonary disease need to be investigated in cohort**

studies that compare younger and older patients. Subsequently, a randomized controlled trial might be needed to compare outcomes in elderly patients who undergo a standard volume-reduction procedure with similar patients who do not.

New Research Addressing This Question: Currently, lung volume reduction surgery is most commonly performed bilaterally, via thoracoscopy or median sternotomy using linear staple reduction techniques, with or without buttressing materials. Given the evidence that this procedure can be beneficial in well-selected patients, investigators have been vigorously pursuing research into innovative alternative methods for achieving lung volume reduction. Many of these new methods are reaching the stage of clinical trials. Currently, three new general conceptual approaches to lung volume reduction surgery are under evaluation: surgical resection with banding devices, endobronchial volume-reducing methods, and endobronchial bronchial bypass approaches. [24] There are theoretical approaches and technical issues that must be investigated for each approach, and studies are under way to evaluate the relative risk and benefit of these procedures, as compared with lung volume reduction surgery, in patients with emphysema.

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

ThoracicSurg 10 (Level A): **Randomized trials are needed to evaluate the efficacy of minimally invasive techniques and compare them with standard thoracotomy for the management of empyema in elderly patients.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

ESOPHAGEAL CANCER

See *New Frontiers,* pp. 123–132.

ThoracicSurg 11 (Level B): **Screening endoscopic trials should be performed for elderly patients with longstanding reflux or a history of Barrett's esophagus to determine if early detection and treatment of high-grade dysplasia is cost-effective.**

New Research Addressing This Question: Medical management of Barrett's esophagus with no dysplasia or with metaplasia is based on the symptomatic control of gastroesophageal reflux using histamine-receptor antagonists or proton-pump inhibitors. Medical management may also include lifestyle modifications, such as weight loss, sleeping with the head of the bed elevated, avoidance of late-night meals, and dietary exclusion of fat and alcohol. The aim of medical therapy is based on symptomatic control of gastroesophageal reflux. Endoscopic surveillance must also be performed to evaluate progression to high-grade dysplasia or adenocarcinoma. Endoscopy is performed on patients with severe symptoms of gastroesophageal reflux, especially those with a family history of

Barrett's esophagus or esophageal cancer. Once the diagnosis of metaplasia is established, routine endoscopic screening with biopsy every 1 to 2 years is indicated. The interval is decreased to 6 months if low-grade dysplasia is present. [25]

Surgical management for uncomplicated Barrett's esophagus (metaplasia or low-grade dysplasia, without stricture) consists of fundoplication for gastroesophageal reflux in the appropriate patient. Patients with high-grade dysplasia may be candidates for mucosal ablative therapy, with photodynamic therapy [26] or with radio frequency ablation. [27] Esophagectomy with cervical esophagogastrostomy may be performed in patients with Barrett's esophagus who present with bleeding, perforation, or fistulization.

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

> ***ThoracicSurg 12 (Levels B, A)***: **Nonrandomized chemoprevention trials targeted specifically toward at-risk elderly patients should be continued, to be followed by a randomized controlled trial of chemoprevention using the most promising agent and comparing it with usual care.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

> ***ThoracicSurg 13 (Level B)***: **The Society of Thoracic Surgeons database and other similar databases should be used to gather data on the impact of age-related comorbidities and other factors related to operative management on the outcomes of esophagectomy for elderly patients.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

> ***ThoracicSurg 14 (Level B)***: **A national database for collecting morbidity and long-term survival rates of minimally invasive techniques for esophageal cancer should be established.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

> ***ThoracicSurg 15 (Level B)***: **Esophagectomy needs to be evaluated for effectiveness as a procedure for improving quality of life and preventing complications of aspiration in elderly patients.**

New Research Addressing This Question: It is recommended that operable patients with T1-T2 esophageal carcinoma proceed with surgery. [28] The choice of surgical procedure depends on the preferences of the surgeon, and choices include transhiatal, Ivor Lewis, and McKeown esophagogastrectomy. Advocates of the transhiatal approach (in which a cervical and celiac lymph node dissection may still be performed) have demonstrated that overall survival is equivalent and that overall morbidity is less. [28]

Rice et al reported their results with preoperative chemotherapy and radiation therapy for esophageal cancer in elderly patients. In this study, 312 consecutive patients underwent esophagectomy for esophageal cancer. Outcomes of patients aged 70 years and older who underwent preoperative therapy were compared with those of patients younger than 70 years who received preoperative therapy. There were no differences between the two groups in the rates of postoperative cardiac, pulmonary, neurologic, gastrointestinal, or anastomotic complications. [29]

Despite surgical and anesthetic advances over the years, morbidity and mortality rates of esophageal resection have been consistently higher than those associated with other commonly performed general and thoracic surgical procedures. Birkmeyer et al analyzed the effect of hospital volume on outcome from complex surgical procedures using information from the national Medicare claims database. Mortality was found to decrease as volume increased for all types of procedures analyzed, but the relative importance of volume varied markedly according to the type of procedure. For esophageal resection, adjusted mortality rates at very-low-volume hospitals were 11.9% higher than at very-high-volume hospitals. [1] In a subsequent study, the effect of surgeon volume was investigated. In this study, surgeon volume was found to be inversely related to operative mortality for all procedures studied. The adjusted odds ratio for operative death (for patients with a low-volume surgeon versus those with a high-volume surgeon) varied widely according to the procedure, and surgeon volume accounted for a large proportion of the apparent effect of the hospital volume, accounting for 46% of mortality for esophagectomy. For most procedures, including esophageal resection and lung resection, the mortality rate was found to be higher among patients of low-volume surgeons than among those of high-volume surgeons, regardless of the surgical volume of the hospital in which they practiced. [2]

Improvements in perioperative care, surgical techniques, and anesthetic techniques have consistently led to decreased complication rates, but esophagectomy remains a formidable operation. Many analyses have been performed to identify the most important risk factors for esophagectomy. [30–36] Perhaps the most important contributor to morbidity and mortality after esophagectomy is the development of pulmonary complications. [37–43] Other factors have been demonstrated in individual studies to be associated with increased mortality after esophagectomy: age, atrial fibrillation, operative approach, extent of resection, genetic and immune factors, nutrition, the use of induction therapy, and pain management. [37] However, the importance of these factors varies across studies, with the exception of age. [44]

Several factors have been associated with pulmonary complications after esophagectomy, including issues related to the preoperative status (age, nutritional status, induction therapy, baseline pulmonary function, ethanol use, smoking history, poor performance status), intraoperative details (stage and location of tumor, surgical approach, estimated blood loss, length of surgical procedure, entry into two separate body cavities,

disruption of bronchial innervation and lymphatic circulation), and postoperative details (pulmonary toilet, vocal cord paralysis or recurrent laryngeal nerve palsy, postoperative respiratory muscle dysfunction). In one series, pulmonary morbidity was the primary cause of death in 54.5% of patients, and respiratory failure associated with pneumonia was an important component of the clinical course in over 80% of deaths. [37] Similarly, Dumont et al also noted that 2/3 of all fatal complications were respiratory in nature. [39] In the Avendano et al study of 61 patients after esophagectomy, all patients who died postoperatively experienced pneumonia. [38] Kinugasa et al found the development of pneumonia after esophagectomy to be associated with worse prognosis for overall survival ($P < .01$), along with pathologic tumor stage, and they showed that those with pneumonia had 5-year survival of 26.7%, while those without pneumonia had 53.4% survival at 5 years. [41]

One of the most consistently proven preoperative factors associated with postoperative pulmonary morbidity is advanced age. Sauvanet et al showed pulmonary morbidity to be associated with age above 60 years. [35] Kozlow et al also show a strong association between aspiration pneumonia and age. [45] In addition, advanced age has also been shown to be an independent predictor of mortality after esophagectomy. [30,37,42]

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

***ThoracicSurg 16 (Level B)*: Instruments to measure age-specific outcomes of surgery for esophageal cancer need to be developed and validated. Functional status and quality of life should be among the outcomes assessed.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

***ThoracicSurg 17 (Level A)*: Large clinical esophageal cancer trials should incorporate the age-specific instruments described in ThoracicSurg 16.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

***ThoracicSurg 18 (Level B)*: Esophagectomy could be used as a model for highly complex surgical procedures in the elderly patient to answer the following questions:**

- **What makes the high-volume center able to provide better care for elderly esophagectomy patients?**
- **Do high-volume centers achieve better surgical outcomes with the oldest-old patients?**

- **In what ways can care be improved for the elderly patient after esophagectomy?**
- **Once a formula for success is characterized, is it applicable to the care of elderly patients receiving other types of major operations?**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

BENIGN ESOPHAGEAL DISEASE

See *New Frontiers,* pp. 133–134.

ThoracicSurg 19 (Level B): **A structured literature review should be performed and a consensus conference between gastroenterologists and surgeons should be organized to establish criteria, based on symptoms and quality of life, for intervention in the management of gastroesophageal reflux disease, particularly in elderly patients.**

New Research Addressing This Question: No new research addressing this question reported during the current search period from October 2002 to December 2005 has come to light.

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

ThoracicSurg 20 (Level A): **A prospective trial of laparoscopic antireflux surgery comparing elderly patients with younger matched control patients operated on during the same period should be performed to determine the suitability of this operation for the elderly patient.**

New Research Addressing This Question: The advisability of such aggressive antireflux therapy for all patients with gastroesophageal reflux disease remains controversial, although advocates of this aggressive approach argue that acid reflux is the main factor contributing to carcinogenesis and that its elimination should prevent cancer. [25]

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

RESEARCH IN SUPPORT OF IMPROVED CARE

See *New Frontiers,* pp. 134–135. This discussion contained no research agenda items.

NEW HORIZONS IN GERIATRIC GENERAL THORACIC SURGERY

New technologies just emerging may make major changes in the way that we diagnose and stage lung and esophageal cancer. These techniques include magnetic navigation

bronchoscopy, [46] endoscopic bronchoscopic ultrasound biopsy, [47] and endoscopic confocal microscopy. [48] It is conceivable that a simple bronchoscopy or CT-guided biopsy may obtain enough tissue to confirm cancer and develop a genetic footprint of the tumor. On the basis of current studies, some patients may go straight to chemotherapy or combined modality therapy. The endoscopic bronchoscopic ultrasound biopsy may replace mediastinoscopy for staging locally advanced cancers. The endoscopic confocal microscopy may allow in-situ diagnosis of cancer both in the esophagus and in the airway. We may be able to detect such early cancers as to allow curative therapies that are concentrated at the surface of the mucosa. Clinical studies are necessary to confirm the reproducibility of the results before therapeutic trials may begin. These diagnostic techniques are especially suitable to the elderly population.

ThoracicSurg 21 (Level A): **Genetic profiles should be collected on lung and esophageal cancer and paired with data on long-term survival to assess traditional staging and revise the staging system as needed.**

ThoracicSurg 22 (Level B): **Observational studies are needed to compare new technologies for diagnosis and staging of lung and esophageal cancer with traditional methods.**

REFERENCES

1. Birkmeyer JD, Siewers AE, Finlayson EV, et al. Hospital volume and surgical mortality in the United States. N Engl J Med 2002;346:1128-1137.
2. Birkmeyer JD, Stukel TA, Siewers AE, et al. Surgeon volume and operative mortality in the United States. N Engl J Med 2003;349:2117-2127.
3. Ettinger DS, Bepler G, Bueno R, et al. Non-small cell lung cancer clinical practice guidelines in oncology. J Natl Compr Canc Netw 2006;4:548-582.
4. LoCicero J, 3rd, Yee J. Geriatric general thoracic surgery. In Solomon DH, LoCicero J, 3rd, Rosenthal RA (eds): New Frontiers in Geriatrics Research: An Agenda for Surgical and Related Medical Specialties. New York: American Geriatrics Society, 2004, pp. 111-145 (online at http://www.frycomm.com/ags/rasp).
5. Henschke CI, McCauley DI, Yankelevitz DF, et al. Early Lung Cancer Action Project: overall design and findings from baseline screening. Lancet 1999;354:99-105.
6. Henschke CI, Yankelevitz DF, Libby DM, et al. Survival of patients with stage I lung cancer detected on CT screening. N Engl J Med 2006;355:1763-1771.
7. Lemaire A, Nikolic I, Petersen T, et al. Nine-year single center experience with cervical mediastinoscopy: complications and false negative rate. Ann Thorac Surg 2006;82:1185-1189; discussion 1189-1190.
8. Gonzalez-Stawinski GV, Lemaire A, Merchant F, et al. A comparative analysis of positron emission tomography and mediastinoscopy in staging non-small cell lung cancer. J Thorac Cardiovasc Surg 2003;126:1900-1905.
9. Reed CE, Harpole DH, Posther KE, et al. Results of the American College of Surgeons Oncology Group Z0050 trial: the utility of positron emission tomography in staging potentially operable non-small cell lung cancer. J Thorac Cardiovasc Surg 2003;126:1943-1951.
10. D'Amico TA. Molecular staging and the selection of therapy for non-small cell lung cancer. Semin Thorac Cardiovasc Surg 2005;17:180-185.

11. Brooks KR, To K, Joshi MB, et al. Measurement of chemoresistance markers in patients with stage III non-small cell lung cancer: a novel approach for patient selection. Ann Thorac Surg 2003;76:187-193; discussion 193.
12. Sullivan V, Tran T, Holmstrom A, et al. Advanced age does not exclude lobectomy for non-small cell lung carcinoma. Chest 2005;128:2671-2676.
13. Matsuoka H, Okada M, Sakamoto T, Tsubota N. Complications and outcomes after pulmonary resection for cancer in patients 80 to 89 years of age. Eur J Cardiothorac Surg 2005;28:380-383.
14. Sawada S, Komori E, Nogami N, et al. Advanced age is not correlated with either short-term or long-term postoperative results in lung cancer patients in good clinical condition. Chest 2005;128:1557-1563.
15. de Rijke JM, Schouten LJ, ten Velde GP, et al. Influence of age, comorbidity and performance status on the choice of treatment for patients with non-small cell lung cancer; results of a population-based study. Lung Cancer 2004;46:233-245.
16. Non-small Cell Lung Cancer Collaborative Group. Chemotherapy for non-small cell lung cancer. Cochrane Database Syst Rev 2000:CD002139.
17. Arriagada R, Bergman B, Dunant A, et al. Cisplatin-based adjuvant chemotherapy in patients with completely resected non-small-cell lung cancer. N Engl J Med 2004;350:351-360.
18. Strauss GM, Jerndon J, Maddaus MA, et al. Randomized clinical trial of adjuvant chemotherapy with paclitaxel and carboplatin following resection in Stage 1B non-small cell lung cancer (NSCLC): Report of Cancer and Leukemia Group B (CALGB) Protocol 9633. ASCO Annual Meeting Proceedings (Post-Meeting Edition). J Clin Oncol 2004;22:7019.
19. Winton T, Livingston R, Johnson D, et al. Vinorelbine plus cisplatin vs. observation in resected non-small-cell lung cancer. N Engl J Med 2005;352:2589-2597.
20. Betticher DC, Hsu Schmitz SF, Totsch M, et al. Mediastinal lymph node clearance after docetaxel-cisplatin neoadjuvant chemotherapy is prognostic of survival in patients with stage IIIA pN2 non-small-cell lung cancer: a multicenter phase II trial. J Clin Oncol 2003;21:1752-1759.
21. Daniels LJ, Balderson SS, Onaitis MW, D'Amico TA. Thoracoscopic lobectomy: a safe and effective strategy for patients with stage I lung cancer. Ann Thorac Surg 2002;74:860-864.
22. Onaitis MW, Petersen RP, Balderson SS, et al. Thoracoscopic lobectomy is a safe and versatile procedure: experience with 500 consecutive patients. Ann Surg 2006;244:420-425.
23. Petersen RP, Pham D, Toloza EM, et al. Thoracoscopic lobectomy: a safe and effective strategy for patients receiving induction therapy for non-small cell lung cancer. Ann Thorac Surg 2006;82:214-218; discussion 219.
24. Brenner M, Hanna NM, Mina-Araghi R, et al. Innovative approaches to lung volume reduction for emphysema. Chest 2004;126:238-248.
25. Spechler SJ. Clinical practice. Barrett's esophagus. N Engl J Med 2002;346:836-842.
26. Overholt BF, Panjehpour M, Halberg DL. Photodynamic therapy for Barrett's esophagus with dysplasia and/or early stage carcinoma: long-term results. Gastrointest Endosc 2003;58:183-188.
27. Bergman JJ, Sondermeijer C, Peters FP, et al. Circumferential balloon-based radiofrequency ablation of Barrett's esophagus in patients with low-grade dysplasia or high-grade dysplasia with and without a prior endoscopic resection using the HALO360 ablation system. Gastrointest Endosc 2006;63:Abstract 137.
28. Ajani J, Bekaii-Saab T, D'Amico TA, et al. Esophageal Cancer Clinical Practice Guidelines. J Natl Compr Canc Netw 2006;4:328-347 (available online: http://www.nccn.org/professionals/physician_gls/PDF/esophageal.pdf).

29. Rice DC, Correa AM, Vaporciyan AA, et al. Preoperative chemoradiotherapy prior to esophagectomy in elderly patients is not associated with increased morbidity. Ann Thorac Surg 2005;79:391-397; discussion 391-397.
30. Bailey SH, Bull DA, Harpole DH, et al. Outcomes after esophagectomy: a ten-year prospective cohort. Ann Thorac Surg 2003;75:217-222; discussion 222.
31. Bartels H, Stein HJ, Siewert JR. Risk analysis in esophageal surgery. Recent Results Cancer Res 2000;155:89-96.
32. Ferguson MK, Martin TR, Reeder LB, Olak J. Mortality after esophagectomy: risk factor analysis. World J Surg 1997;21:599-603; discussion 603-594.
33. Jamieson GG, Mathew G, Ludemann R, et al. Postoperative mortality following oesophagectomy and problems in reporting its rate. Br J Surg 2004;91:943-947.
34. Rizk NP, Bach PB, Schrag D, et al. The impact of complications on outcomes after resection for esophageal and gastroesophageal junction carcinoma. J Am Coll Surg 2004;198:42-50.
35. Sauvanet A, Mariette C, Thomas P, et al. Mortality and morbidity after resection for adenocarcinoma of the gastroesophageal junction: predictive factors. J Am Coll Surg 2005;201:253-262.
36. Whooley BP, Law S, Murthy SC, et al. Analysis of reduced death and complication rates after esophageal resection. Ann Surg 2001;233:338-344.
37. Atkins BZ, Shah AS, Hutcheson KA, et al. Reducing hospital morbidity and mortality following esophagectomy. Ann Thorac Surg 2004;78:1170-1176.
38. Avendano CE, Flume PA, Silvestri GA, et al. Pulmonary complications after esophagectomy. Ann Thorac Surg 2002;73:922-926.
39. Dumont P, Wihlm JM, Hentz JG, et al. Respiratory complications after surgical treatment of esophageal cancer: a study of 309 patients according to the type of resection. Eur J Cardiothorac Surg 1995;9:539-543.
40. Ferguson MK, Durkin AE. Preoperative prediction of the risk of pulmonary complications after esophagectomy for cancer. J Thorac Cardiovasc Surg 2002;123:661-669.
41. Kinugasa S, Tachibana M, Yoshimura H, et al. Postoperative pulmonary complications are associated with worse short- and long-term outcomes after extended esophagectomy. J Surg Oncol 2004;88:71-77.
42. Law S, Wong KH, Kwok KF, et al. Predictive factors for postoperative pulmonary complications and mortality after esophagectomy for cancer. Ann Surg 2004;240:791-800.
43. Leo F, Venissac N, Palihovici R, et al. Aristotle, esophagectomy, and pulmonary complications. Ann Thorac Surg 2004;77:1503.
44. Poon RT, Law SY, Chu KM, et al. Esophagectomy for carcinoma of the esophagus in the elderly: results of current surgical management. Ann Surg 1998;227:357-364.
45. Kozlow JH, Berenholtz SM, Garrett E, et al. Epidemiology and impact of aspiration pneumonia in patients undergoing surgery in Maryland, 1999-2000. Crit Care Med 2003;31:1930-1937.
46. Gildea TR, Mazzone PJ, Karnak D, et al. Electromagnetic navigation diagnostic bronchoscopy: a prospective study. Am J Respir Crit Care Med 2006;174:982-989.
47. Yasufuku K, Nakajima T, Motoori K, et al. Comparison of endobronchial ultrasound, positron emission tomography, and CT for lymph node staging of lung cancer. Chest 2006;130:710-718.
48. Hoffman A, Goetz M, Vieth M, et al. Confocal laser endomicroscopy: technical status and current indications. Endoscopy 2006;38:1275-1283.