the optimal interval for CT scans remains unclear in GGO surveillance, the duration of radiographic follow-up to conclude a benign nature is much longer for a GGO than for a pure solid lesion.⁴ As documented in the Italian MILD trial, over a 50-month follow-up period, the rate of GGO progression to cancer was very low, with 70% of lesions remaining stable, resolving, or decreasing in size.⁵ Such reports of stability pose a concern for overtreatment in the current article, in which 63% of patients underwent an operation, with <6 months of preoperative radiographic surveillance.

In this low-risk cohort, patients have little to gain from CT scans and all the well-established risks of radiation. Furthermore, we do not know the true denominator—under this model of care, how many patients receive an unnecessary scan, based on current guidelines? How many patients are exposed to unnecessary radiation?

Given the lack of strong evidence to support resection of GGO,^{4,5} our current institutional approach has erred toward

radiographic follow-up with adherence to current screening recommendations.² Zhang and colleagues offer an aggressive counterpoint with excellent surgical results but lingering uncertainty as to the overall benefit.

References

1. Zhang Y, Ma X, Shen X, Wang S, Li Y, Hu H, et al. Surgery for pre- and minimally invasive lung adenocarcinoma. *J Thorac Cardiovasc Surg*. 2022;163:456-64.
2. US Preventive Service Task Force. Lung cancer: screening. Draft recommendation statement. Accessed January 21, 2021. Available at: <https://www.uspreventiveservicestaskforce.org/uspstf/draft-recommendation/lung-cancer-screening1>.
3. Hattori A, Suzuki K, Takamochi K, Wakabayashi M, Aokage K, Saji H, et al. Prognostic impact of a ground-glass opacity component in clinical stage IA non-small cell lung cancer. *J Thorac Cardiovasc Surg*. April 6, 2020 [Epub ahead of print].
4. Migliore M, Fornito M, Palazzolo M, Criscione A, Gangemi M, Borrata F, et al. Ground-glass opacities management in the lung cancer screening era. *Ann Transl Med*. 2018;6:90.
5. Silva M, Sverzellati N, Manna C, Negrini G, Marchianò A, Zompatori M, et al. Long-term surveillance of ground-glass nodules: evidence from the MILD trial. *J Thorac Oncol*. 2012;7:1541-6.

See Article page 456.

Commentary: Sublobar resection for in situ and minimally invasive adenocarcinoma—less is more

Benjamin Wei, MD, and
Juan A. Muñoz-Largacha, MD

The implementation of lung cancer screening programs has led to increased detection of smaller lung nodules and ground glass opacities (GGOs).¹ In China, screening of a

Benjamin Wei, MD, and Juan A. Muñoz-Largacha, MD

CENTRAL MESSAGE

The therapeutic approach for pulmonary AIS/MIA remains controversial. Sublobar resection may be an adequate strategy with promising survival outcomes.

traditionally “non-high-risk” population has revealed many early-stage (0/IA) lung cancers.² Lobectomy continues to be considered the standard of care for early-stage lung cancer as described previously.³ However, the appropriate management of and therapeutic approach to adenocarcinoma in situ (AIS) and minimally invasive adenocarcinoma (MIA) remain controversial. In their

From the Division of Cardiothoracic Surgery, Department of Surgery, University of Alabama at Birmingham, Birmingham, Ala.

Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Jan 5, 2021; revisions received Jan 5, 2021; accepted for publication Jan 6, 2021; available ahead of print Jan 13, 2021.

Address for reprints: Benjamin Wei, MD, Division of Cardiothoracic Surgery, Department of Surgery, University of Alabama at Birmingham, 703 19th St South, Zeigler Research Building, Room 701, Birmingham, AL 35294 (E-mail: bwei@uab.edu).

J Thorac Cardiovasc Surg 2022;163:467-8

0022-5223/\$0.00

Published by Elsevier Inc. on behalf of The American Association for Thoracic Surgery

<https://doi.org/10.1016/j.jtcvs.2021.01.005>

article in this issue of the *Journal*, Zhang and colleagues⁴ present the outcomes after surgical resection of 1644 patients (74% women; 84% nonsmokers; mean age, 53 years) with pathologically diagnosed AIS and MIA. They report a 5-year overall survival of 98.8% and a recurrence-free survival of 100%. Wedge resection was associated with a lower rate of postoperative complications, shorter operative times and decreased length of stay compared with the segmentectomy/lobectomy group, without compromising survival.

A few details merit mention. Computed tomography-guided hookwire localization was performed for most of the lesions. Interestingly, this technique was performed even in 75% of patients undergoing lobectomy. Perhaps the investigators could not tell that a patient would need a lobectomy based on preoperative imaging alone? While different techniques have been described for the localization of small lung nodules/GGOs before surgical resection,^{5,6} we believe one of these strategies should be considered when sublobar resection is planned.

Second, the successful implementation of this strategy depends on highly accurate frozen section analysis to dictate the extension of resection. In this study, only 2.4% of patients were overdiagnosed as harboring invasive adenocarcinoma, and 5.1% were underdiagnosed as having benign lesions or atypical adenomatous hyperplasia by frozen section. Overdiagnosis could lead to more extensive resection without additional clinical benefit. Underdiagnosis could lead to inadequate oncologic resection. However, this same group of investigators has demonstrated that even patients with invasive adenocarcinoma who were misdiagnosed as having AIS/MIA have an excellent prognosis.⁷

Finally, the authors reported no evidence of metastasis in any of the lymph nodes examined, which shows that this aspect of the operation likely could be omitted in patients with known AIS/MIA. In the real world, however, pausing an operation to wait for frozen section results before

embarking on lymphadenectomy could unnecessarily extend the duration of the operation. In addition, foregoing lymphadenectomy might not be ideal if the final diagnosis ends up being invasive adenocarcinoma.

The big question, remains unanswered however: does surgical resection change overall survival for patients with MIA/AIS? The study does not address this question. Others have shown that >90% of pure GGOs do not grow when followed over a 5-year period; many of these are presumably MIA/AIS.⁸ There is a surprising paucity of data on the subject. Given the challenges in obtaining a reliable diagnosis of AIS/MIA preoperatively and the inability to predict disease progression, the correct approach is still not well defined. With that caveat noted, however, sublobar resection without lymph node dissection appears to be an attractive option for the management of known AIS/MIA.

References

1. National Lung Screening Trial Research Team, Church TR, Black WC, Aberle DR, Berg CD, Clingan KL, et al. Results of initial low-dose computed tomographic screening for lung cancer. *N Engl J Med*. 2013;368:1980-91.
2. Zhang Y, Jheon S, Li H, Zhang H, Xie Y, Qian B, et al. Results of low-dose computed tomography as a regular health examination among Chinese hospital employees. *J Thorac Cardiovasc Surg*. 2020;160:824-31.e4.
3. Ginsberg RJ, Rubinstein LV. Randomized trial of lobectomy versus limited resection for T1 N0 non-small cell lung cancer. Lung cancer study group. *Ann Thorac Surg*. 1995;60:615-22; discussion 622-3.
4. Zhang Y, Ma Xi, Shen X, Wang S, Li Y, Hu H, et al. Surgery for pre- and minimally invasive lung adenocarcinoma. *J Thorac Cardiovasc Surg*. 2022;163:456-64.
5. Chen S, Zhou J, Zhang J, Hu H, Luo X, Zhang Y, et al. Video-assisted thoracoscopic solitary pulmonary nodule resection after CT-guided hookwire localization: 43 cases report and literature review. *Surg Endosc*. 2011;25:1723-9.
6. Muñoz-Largacha JA, Ebright MI, Little VR, Fernando HC. Electromagnetic navigational bronchoscopy with dye marking for identification of small peripheral lung nodules during minimally invasive surgical resection. *J Thorac Dis*. 2017;9:802-8.
7. Zhang Y, Deng C, Fu F, Ma Z, Wen Z, Ma X, et al. Excellent prognosis of patients with invasive lung adenocarcinomas intraoperatively misdiagnosed as AAH/AIS/MIA by frozen section. *Chest*. 2020;159:1265-72.
8. Chang B, Hwang JH, Choi Y, Chung MP, Kim H, Kwon OJ, et al. Natural history of pure ground-glass opacity lung nodules detected by low-dose CT scan. *Chest*. 2013;143:172-8.