relevant to the subgroup of patients with MPM who otherwise appear to be candidates for surgical resection by routine imaging modalities. A remaining caveat is that their radiologic technique does not explicitly assess the tumor involvement with the diaphragm, mediastinum, or major thoracic structures (eg, the aorta) as part of the determination of resectability. In fact, the authors encountered the situation where a few patients in the larger cohort undergoing operation were deemed not to be candidates for resection due to tumor invasion of other anatomic structures besides the chest wall. Moving forward, TCV assessment could be a useful preoperative parameter complementary to routine imaging that will favorably influence the surgical care of patients with MPM. We eagerly await updates from the authors in this regard.

See Article page 2512.

Commentary: Know your enemy—Understanding futility in the battle against malignant pleural mesothelioma

Andrew E. Giles, MD, MPH,^a and
Biniam Kidane, MD, MSc^{a,b,c}

Malignant pleural mesothelioma (MPM) presents many challenges for patients and physicians battling this difficult disease. It is difficult to stage, challenging to treat surgically, and poorly responsive to adjuvant therapy. Multimodal treatment strategies have flourished as the

Andrew E. Giles, MD, MPH (left), and Biniam Kidane, MD, MSc (right).

CENTRAL MESSAGE

Novel applications of chest volume analysis may improve prediction of unresectability in malignant pleural mesothelioma. Development and validation of such tools is a promising area of progress.

References

1. Beckett P, Edwards J, Fennell D, Hubbard R, Woolhouse I, Peake MD. Demographics, management and survival of patients with malignant pleural mesothelioma in the National Lung Cancer Audit in England and Wales. *Lung Cancer*. 2015; 88:344-8.
2. Kaufman AJ, Flores RM. Surgical treatment of malignant pleural mesothelioma. *Curr Treat Options Oncol*. 2011;12:201-16.
3. Burt BM, Lee H-S, Raghuram AC, Strange C, Mason J, Strange T, et al. Preoperative prediction of unresectability in malignant pleural mesothelioma. *J Thorac Cardiovasc Surg*. 2020;159:2512-20.e1.
4. Rice DC, Erasmus JJ, Stevens CW, Vaporciyan AA, Wu JS, Tsao AS, et al. Extended surgical staging for potentially resectable malignant pleural mesothelioma. *Ann Thorac Surg*. 2005;80:1988-92.
5. Patz EF Jr, Shaffer K, Pivnicka-Worms DR, Jochelson M, Sarin S, Sugarbaker DJ, et al. Malignant pleural mesothelioma: value of CT and MR imaging in predicting resectability. *AJR Am J Roentgenol*. 1992;159:961-6.
6. Gillies RJ, Kinahan PE, Hricak H. Radiomics: images are more than pictures, they are data. *Radiology*. 2016;278:563-77.

From the ^aSection of Thoracic Surgery, Department of Surgery, Max Rady College of Medicine, ^bDepartment of Community Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada; and ^cResearch Institute in Oncology & Hematology, Cancer Care Manitoba, Winnipeg, Manitoba, Canada.

Drs Giles and Kidane contributed equally to the conception and writing of this editorial. Drs Giles and Kidane have undertaken final review and approved.

Funding: No funding was received in relation to this work.

Disclosures: Authors have nothing to disclose with regard to commercial support.

Received for publication Jan 5, 2020; revisions received Jan 5, 2020; accepted for publication Jan 5, 2020; available ahead of print Feb 29, 2020.

Address for reprints: Biniam Kidane, MD, MSc, GE-611, 820 Sherbrook St, Health Sciences Centre, Winnipeg, Manitoba R3A 1R9, Canada (E-mail: bkidane@hsc.mb.ca).

J Thorac Cardiovasc Surg 2020;159:2523-4
0022-5223/\$36.00

Copyright © 2020 by The American Association for Thoracic Surgery
<https://doi.org/10.1016/j.jtcvs.2020.01.034>

thoracic oncology community grapples with these problems.^{1,2} For selected patients with early stage disease and favorable histologic type, surgery can be part of a curative approach³; however, surgery can also be a painful and ultimately fruitless undertaking in many patients.⁴ Futile surgery is harmful in many ways; it can reduce quality of life and delay or disqualify patients from receiving other, more appropriate therapies.

In their article in this issue of the *Journal*, Burt and colleagues⁵ have attempted to devise a way to prevent futile surgery in a more objective fashion. With computed tomographic volumetric analysis, a series of 170 patients undergoing surgery for MPM were analyzed retrospectively. Fourteen percent had unresectable disease because of diffuse chest wall invasion. Burt and colleagues⁵ compared affected versus unaffected hemithorax and found that a 5% decrease in thoracic cavity volume bore a sensitivity, specificity, and accuracy of 75%, 57%, and 60%, respectively, for predicting diffuse chest wall invasion. This method outperformed magnetic resonance imaging assessment.

These promising results must be held in balance with several limitations. Volumetric analysis has been used before,⁶ primarily for correlating with T stage, predicting long-term outcomes, and assessing response to chemotherapy.⁷ The specific method described by Burt and colleagues⁵ bears similarity to previous reports, but it is not validated in terms of either technique or outcomes. Radiologist agreement has not been assessed, and that would be an important step before institution of this metric among other radiologists. A lack of reproducibility would hamper the use of this tool elsewhere. Finally, because of the small sample size and number of events, Burt and colleagues⁵ were not able to control for confounding. Although recognizing that this is difficult to accomplish in studies of MPM, it nonetheless limits our ability to draw conclusions about the specific contribution of changes in thoracic cavity volume in determining resectability because of diffuse chest wall invasion.

Although the limitations of the study preclude immediate uptake of thoracic cavity volume as a metric for determining resectability preoperatively, this study nevertheless opens a new area for exploration. As Burt and colleagues⁵ adroitly point out, for patients with locally advanced mesothelioma, avoidance of delay to systemic therapy is key. Circumvention of futile thoracotomy is therefore a meaningful goal, and this study represents an important initial step into determining objective means of accomplishing this.

Beyond the immediate goal of determining resectability for an individual patient, volumetric analysis could help change the broader management of MPM. Although it is

recommended that patients with mesothelioma should be cared for in a specialized center,³ placement in such a center is not always possible or accessible to patients. Consequently, national practice patterns vary widely.^{2,8} Computed tomography is a widely available technology that can be used to screen patients close to where they live. Images can be processed and analyzed remotely at expert centers, allowing better selection of patients who can then proceed to on-site intensive evaluation and potential multimodal surgical therapy.

Burt and colleagues⁵ make a valuable contribution not only to the literature on MPM but also to our tool set and approach to the disease. There is no doubt that MPM is difficult to evaluate and treat, but with further investigation into preoperative determination of resectability, we may spare patients futile therapy and increase access to appropriate management for some patients who previously were excluded.

References

1. Richards WG. Malignant pleural mesothelioma: predictors and staging. *Ann Transl Med*. 2017;5:243-52.
2. Friedberg JS, Culligan MJ, Tsao AS, Rusch V, Sepesi B, Pass HI, et al. A proposed system toward standardizing surgical-based treatments for malignant pleural mesothelioma, from the joint National Cancer Institute-International Association for the Study of Lung Cancer-Mesothelioma Applied Research Foundation Taskforce. *J Thorac Oncol*. 2019;14:1343-53.
3. National Comprehensive Cancer Network. NCCN clinical practice guidelines in oncology (NCCN guidelines): Malignant pleural mesothelioma v1. 2020. Available at: https://www.nccn.org/professionals/physician_gls/pdf/mpm.pdf. Accessed December 21, 2019.
4. Treasure T, Lang-Lazdunski L, Waller D, Bliss JM, Tan C, Entwisle J, et al; MARS Trialists. Extra-pleural pneumonectomy versus no extra-pleural pneumonectomy for patients with malignant pleural mesothelioma: clinical outcomes of the Mesothelioma and Radical Surgery (MARS) randomised feasibility study. *Lancet Oncol*. 2011;12:763-72.
5. Burt BM, Lee HS, Raghuram AC, Strange C, Mason J, Strange T, et al. Preoperative prediction of unresectability in malignant pleural mesothelioma. *J Thorac Cardiovasc Surg*. 2020;159:2512-20.e1.
6. Pass HI, Temeck BK, Kranda K, Steinberg SM, Feuerstein IR. Preoperative tumor volume is associated with outcome in malignant pleural mesothelioma. *J Thorac Cardiovasc Surg*. 1998;115:310-7; discussion 317-8.
7. Rusch VW, Gill R, Mitchell A, Naidich D, Rice DC, Pass HI, et al; Malignant Mesothelioma Volumetric CT Study Group. A multicenter study of volumetric computed tomography for staging malignant pleural mesothelioma. *Ann Thorac Surg*. 2016;102:1059-66.
8. Verma V, Ahern CA, Berlind CG, Lindsay WD, Shabason J, Sharma S, et al. Survival by histologic subtype of malignant pleural mesothelioma and the impact of surgical resection on overall survival. *Clin Lung Cancer*. 2018;19:e901-12.