Commentary: Ultrasonic energy to divide pulmonary arteries:—"Don't expect a blowout!"

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When I was asked to review the manuscript of the article by Liberman and colleagues¹ appearing in this issue of the *Journal*, I hesitated for a moment because I knew it was going to require a significant investment of time that I did not have. I would have to borrow again. Then I reminded myself that it is an essential service to my surgical community and another opportunity for me to learn. I wish it were possible to pay back the debt that others have incurred by spending their valuable time reviewing my work, both good and not so good. If you are reading this, let it be said that I cannot thank you enough! Being engaged in the peer-review process also offers interesting opportunities such as this.

First, Liberman and colleagues¹ are to be commended for designing, implementing, and completing a prospective, multicenter, single-arm trial in thoracic surgery. This is a gargantuan undertaking that combines high-quality evidence with great potential to influence clinical practice. We can always nitpick regarding methodologic details and potential sources of bias. For instance, the number of patients screened appears low, given the time frame (2.5 years) and the number of major centers involved (8 thoracic units). In the end, though, we need to recognize that the approach of Liberman and colleagues¹ was sound and scientifically rigorous.

After watching countless video presentations, observing surgeries, and discussing the issue with colleagues, it seems that alternatives to surgical staplers are already commonplace during bronchovascular dissection, division of pulmonary arteries, and completion of pulmonary fissures. Instrumentation includes ultrasonic and bipolar energy devices and locking clips. The marketing that I have been subject to states that arteries as large as 7 mm in diameter can be safely sealed and divided with ultrasonic energy. Some surgeons have expressed reservations arising from structural differences between systemic and pulmonary arteries. Pulmonary arteries are fragile and

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Central Message

Ultrasonic energy shows promising safety and efficacy in sealing and dividing small pulmonary arterial branches during lung resection.

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thin-walled, have less smooth muscle, and lack effective hemostatic tone relative to their systemic counterparts. To alleviate concerns, the same group previously demonstrated high mean burst pressure (>300 mm Hg) after ex vivo sealing human pulmonary artery branches with the same ultrasonic energy device tested in this study (see references 6 and 15 of their publication¹). Following suit, they have now published nonrandomized, prospective observational data showing an intraoperative sealing effectiveness of 98.3% (236/239 vessels). Each of the 3 instances of bleeding occurred in a different patient, and 1 required open conversion for suture hemostasis. Vessel sealing attempts were thus successful in 98% (147/150) of patients. This performance appears comparable to that of staplers, except that stapled vessels were of larger average size (10 mm vs 5 mm).

A few things came to mind when reading the manuscript. For instance, it would be interesting to know what methodology was used to determine the size cutoff of 7 mm or smaller. Disseminating critical appraisal of the evidence in support of this cutoff could help reassure surgeons and promote adoption. I also wondered about practicality and compliance when it comes to measuring a vessel with a ruler before division during thoracoscopy. This was mandated in the study and did not seem to affect procedural difficulty or ease of use according to surveys completed by the 15 participating surgeons. Will this be done routinely in clinical practice? Will companies eventually print a measuring gauge on the instrument as

an aid? Liberman and colleagues¹ also emphasized that educational material was created for surgeon training and credentialing. It is to be hoped that this educational material will be shared widely in the future. Rightfully so, Liberman and colleagues¹ also gave words of wisdom and caution. They created a table to emphasize key points in obtaining the best vessel sealing outcome and warned against extrapolating the results of their trial to nonultrasonic devices. The terms “MIN” and “advanced hemostasis” used in the table are device specific. Unless proprietary, the characteristics of these settings could have been explained in terms that would apply to any ultrasonic vessel sealing device (eg, electric power, oscillation frequency, time of sealing treatment). From a scientific standpoint, the rationale for issuing these statements is sound. On the other hand, although industry sponsorship has led to significant advances in medical knowledge, its potential for bias remains difficult to quantify.²

It is safe to say that everyone can understand the apparent gain in versatility from using a 5-mm energy device instead of a 10-mm stapler. It would have been interesting to get some narrative from the surgeons, because they reported that the energy device averted conversion to thoracotomy in almost 1 in every 5 cases. If this observation were truly a cause-and-effect relationship, it would imply a relatively high conversion rate under circumstances where no ultrasonic device is available. More operative details (eg, tumor location and size, incomplete fissures, lymph nodes adherent to vessels) could potentially improve understanding of these

statements. I wonder whether the same could be said of 5-mm clip appliers, which provide a similar instrument profile at a lower cost. It would also have been interesting to know what other components of the operation were successfully completed with the energy device (eg, fissure completion), and whether this had any significant effect on the number of stapler cartridges used. This information could help provide justification for the additional expense associated with an ultrasonic device. In some health care environments, such cost analysis may be mandated before using this technology for routine lung resections.

After successful intraoperative sealing, it seems very unlikely that major pulmonary arterial bleeding would occur postoperatively. The incidence of this potential complication remains unknown. It is not possible to determine whether the study was sufficiently powered to detect it. All in all, we should not expect any sudden disruption in more than 98% of small pulmonary arteries divided with ultrasonic energy. It is also not yet clear whether there is an easy win for this technology in terms of cost savings and efficiency. I look forward to more of this pioneering clinical research in the near future.

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