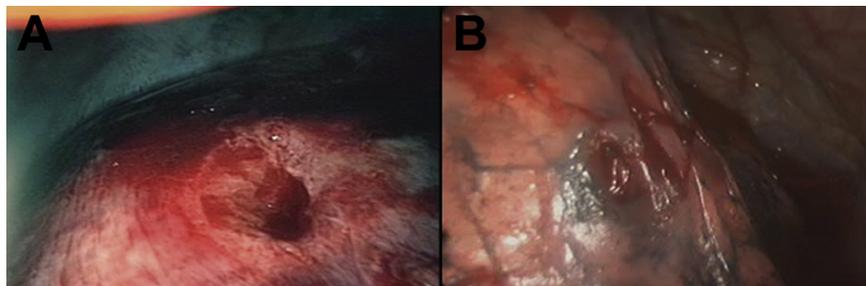


Fig 5. (A) Diaphragm punctured by a chest tube in the emergency room; photograph taken during thoracoscopic surgical procedure. (B) Laceration of lung by a chest tube, which resulted in profound air leaks.



can be designed to be adjustable based on the environment. The clinical conditions for which video-guided tube thoracostomy will be most effective remain to be determined, given that the cases included in this preliminary study are quite limited.

### Conclusion

This study is not intended to replace the standard procedure. However, under certain difficult conditions, video-guided tube thoracostomy may afford a critical advantage and result in a better outcome.

### Disclosures and Freedom of Investigation

The authors received no external funding and bought the complimentary metal oxide semiconductor modules and chips from NewKen Technology Inc. Design and assembly were performed by the authors and by UniMax Ltd. All authors had full control of the design of the study, methods used, outcome parameters, analysis of data and production of the written report.

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### Disclaimer

The Society of Thoracic Surgeons, the Southern Thoracic Surgical Association, and *The Annals of Thoracic Surgery* neither endorse nor discourage use of the new technology described in this article.

### INVITED COMMENTARY

After reading the article by Chen and colleagues [1], I had the typical reaction when introduced to a superbly practical and elegant innovation—a “why didn’t I think of that” moment. Given that many patients require drainage of their pleural spaces, it follows that inspecting the organs requiring such therapies could help many patients.

Identifying blebs causing spontaneous pneumothoraces, evaluating associated injuries in trauma, and viewing effusion loculations or pleural metastases are just a few examples for which this technology could be useful. Besides optimizing tube placements and preventing lung injury, it follows that direct simple endoscopic procedures like pleural biopsy could be performed by the use of small instruments passed beside the drainage catheter.

Greater imaging accessibility brought about by miniaturization and cost reduction is transforming much of what we do. For instance, the similarly constructed Glidescope device improves endotracheal intubation safety. Laparoscopic ports are advanced more carefully

through the abdominal wall with camera-tipped trocars. Capsule endoscopy (<http://www.givenimaging.com>) embodies not only miniaturization and affordability but also the capture of images by wireless transmission.

We can expect that this trend will continue for other imaging techniques. Pocket ultrasound probes are now available as smartphone attachments (<http://www.mobisante.com/product-overview/>) at a fraction of the cost of large systems. Why teach auscultation skills to trainees when they can carry an echocardiography probe in their stethoscope pocket instead? The cost has become so reasonable that disposable transesophageal echocardiography probes for perioperative cardiac monitoring are now available (<http://imacorinc.com/>). Thus, it is logical to expect that others will build on the work of these authors by using chest tubes as portals for enhanced imaging or monitoring of thoracic organs.

Tempering my enthusiasm for the authors’ invention is the current trend to reduce the size of pleural drainage tubes. Smaller, more comfortable catheters work well

for many problems, but they may be too small for imaging devices. The avoidance of unnecessary health-care expenses is important; however, the device described in this paper could be reprocessed to save money or even offset costs like radiographic imaging rendered redundant by video inspection.

Such concerns aside, improving anatomic exposure is a core desire for all surgeons. I hope that innovations like these continue. If they are practical, we should adopt them readily as a specialty to increase their accessibility, to harness their safety potentials, and to use them to study our patients' diseases.

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