

The road to ultimate minimal invasiveness

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Singe-port video-assisted thoracic surgery (SPVATS) has become increasingly popular among thoracic surgeons in recent years. Generally, major pulmonary resection is performed through a single incision (3–5 cm), with the goal of causing potentially less pain, while achieving similar oncologic control compared with conventional VATS procedures (1). The article by Dr. Kim and colleagues (2) describes a successful tri-segmentectomy for a small lesion located in the left upper lobe via a single 2-cm incision.

The ability to shorten the incision for SPVATS may be attributed to ongoing developments in endoscopic equipment, which is becoming smaller and with greater angles of articulation. For example, the 5-mm thoracoscope Kim's group (2) used was able to provide unambiguous images while occupying minimal amount of space at the incision. Future innovations such as a magnetic anchoring guidance system, which would transmit images through a magnet-held, wireless camera placed within the thoracic cavity, may finally eliminate the need for an external thoracoscope. As a result, the wound size could be reduced, and the surgical instruments would not interfere with the conventional scope held by the assistant. Perhaps a more advanced single-incision endoscopic platform incorporating an endoscope and retraction and energy devices would facilitate even more minimally invasive thoracic surgery (3).

Localizing a small pulmonary lesion through a limited incision can be challenging, especially when dealing with ground-glass nodules (GGN) given their partly solid nature. Furthermore, manual palpation may be impossible via a 2-cm incision. There is no evidence whether a dual localization method (e.g., combining

preoperative Lipiodol and radionuclide injection with intraoperative fluoroscopy and a gamma probe) is superior to using only a single technique, in terms of accuracy or cost-effectiveness. Although Kim's group (2) achieved successful identification of GGN, the patient may still inevitably experience discomfort or complications during transportation from the radiology suite for localization to the operating room for surgery. To resolve this clinical issue, we reported the use of a hybrid theatre, which can provide real-time imaging and increase the rate of successful hookwire implantation or electromagnetic navigation bronchoscopy biopsy (4). Hopefully, this will also improve the localization accuracy and safety of sublobar resection during SPVATS.

Last, but not least, lung adenocarcinomas are thought to consist of heterogeneous subtypes, with different expected prognoses. Therefore, rigid selection criteria must be used for segmentectomy candidates. A GGN with a low proportion of consolidation is generally believed to be non-invasive, and may be adenocarcinoma *in situ*, minimally invasive adenocarcinoma, or lepidic predominant adenocarcinoma, which have excellent survival rates and could be treated ideally with sublobar resection. However, performing sublobar resection for pulmonary lesions less than 2 cm remains controversial and should be examined in prospective trials. Notably, adenocarcinoma with micropapillary or solid growth components has significantly worse survival and may not be suitable for sublobar resection (5). The 1.7-cm GGN presented in Kim's group (2) was diagnosed as adenocarcinoma with acinar and lepidic growth and is thought to have a good prognosis and

may be suitable for a segmentectomy.

We appreciate the pioneering work of Kim's group (2) and hope to witness further progress along the road to minimal invasiveness.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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