



# The tips of uniportal thoracoscopic lateral and posterior basal (S<sup>9+10</sup>) segmentectomy

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**Abstract:** The appropriate lateral and posterior basal (S<sup>9+10</sup>) segmentectomy requires exposure and recognition of common basal pulmonary vein or artery branches located deeply in lung parenchyma. It is helpful for thoracic surgeons to know pulmonary vessels running direction information preoperatively to perform appropriate S<sup>9+10</sup> segmentectomy, which is also applied to other complicated segmentectomy. Therefore, a 3-dimensional image of computed tomography angiography (3D-CTA) is performed for any patient who is having pulmonary segmentectomy in our institution. Several procedures were introduced to perform appropriate S<sup>9+10</sup> segmentectomy in previous studies. Among them, unidirectional dissection is considered suitable for uniportal thoracoscopic S<sup>9+10</sup> segmentectomy because the angle of dissection in uniportal approach has limitations although our team previously reported the efficacy of “intersegmental tunneling” method in S<sup>9+10</sup> segmentectomy via multiportal approach. Additionally, we consider that selective inflation of target segment by jet-ventilation or intravenous indocyanine green injection might be better way to identify an intersegmental plane in uniportal thoracoscopic approach due to the limited working space although the best way to identify an intersegmental plane is controversial. In Japan, some institutions use electrocautery to divide the intersegmental plane. However, electrocautery cutting in intersegmental division might not be suitable for uniportal approach because electrocautery cutting requires countertraction which is difficult to perform in uniportal approach. Therefore, we usually use staplers to divide intersegmental plane in uniportal pulmonary segmentectomy. Finally, we show the video describing uniportal thoracoscopic S<sup>9+10</sup> segmentectomy in our institution.

**Keywords:** Uniport; thoracoscopy; S<sup>9+10</sup> segmentectomy; intersegmental tunneling; 3-dimensional image of computed tomography angiography (3D-CTA)

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The appropriate lateral and posterior basal (S<sup>9+10</sup>) segmentectomy requires exposure and recognition of common basal pulmonary vein or artery branches located deeply in lung parenchyma. It is helpful for thoracic surgeons to recognize the branches of pulmonary vessels preoperatively to perform appropriate S<sup>9+10</sup> segmentectomy, which is also applied to other complicated segmentectomy (1,2). Therefore, a 3-dimensional image of computed tomography angiography (3D-CTA) is performed for any patient who is having pulmonary segmentectomy in our institution.

Uniportal thoracoscopic surgery is performed under general anesthesia using one-lung ventilation with the

patient in the lateral decubitus position. An approximately 3.5–4-cm skin incision is placed on the 4th or 5th intercostal space of the anterior axillary line. Several surgical instruments including thoracoscopy are inserted via the single incision simultaneously.

Several procedures were introduced to perform appropriate S<sup>9+10</sup> segmentectomy in previous studies (3–7). The first one is “intersegmental tunneling” method our group described in a previous article (3). In our procedure, we can easily recognize common basal pulmonary vein branches located deeply in lung parenchyma, once the division of the intersegmental plane between S<sup>6</sup> and S<sup>9+10</sup>

after the “intersegmental tunneling” is complete. As a result, the dominant pulmonary vein to S<sup>9+10</sup> is identified, which is mandatory to perform accurate S<sup>9+10</sup> segmentectomy. In this report, we demonstrated five consecutive successful cases who underwent thoracoscopic S<sup>9+10</sup> segmentectomy using “intersegmental tunneling” between April 2014 and December 2015 although our thoracoscopic approach in this period had three or four ports.

While “intersegmental tunneling” requires bidirectional dissection with interlobar area and hilum, Kikkawa and colleague reported a pulmonary ligament approach, which required unidirectional dissection, in thoracoscopic S<sup>9+10</sup> segmentectomy (4). Moreover, other authors also reported similar approach using unidirectional dissection although the name of the approach was different (6,7). In this approach, dissection proceeded from pulmonary ligament to hilum using the intersegmental septum as a landmark. Previously, our group did not apply this method because such unidirectional dissection sometimes leads the surgeon to misunderstand the anatomy if the surgeon does not have sufficient experience. However, this unidirectional dissection is considered suitable for uniportal thoracoscopic S<sup>9+10</sup> segmentectomy because the angle of dissection in uniportal approach has limitations compared to multiportal approach. In addition, the advantage of this approach was no need to consider whether the interlobar fissures were complete or not.

The best way to identify an intersegmental plane is controversial worldwide. Several procedures including “inflation-deflation technique”, “selective inflation of target segment by jet-ventilation” and “intravenous or endobronchial indocyanine green injection” have been introduced (8-12). Although inflation-deflation technique is conventional and most commonly used, the expanded segments by inflation causes the limitations of working space in thorax during thoracoscopic procedures. Uniportal thoracoscopic surgery has limited angulation of surgical instruments, which causes limitations of working space in thorax compared to multiportal thoracoscopic or thoracotomy approach. Moreover, endobronchial indocyanine green injection is not suitable thoracoscopic approach because bronchial stump is temporally opened. Therefore, selective inflation of target segment by jet-ventilation or intravenous indocyanine green injection might be better way to identify an intersegmental plane in uniportal thoracoscopic approach.

In Japan, some institutions use electrocautery to divide the intersegmental plane. Okada and colleague reported the efficacy of using electrocautery for division

of the intersegmental plane detected by selective jet ventilation (13). Previously, we also adopted electrocautery cutting through multiport approach if the lung was not emphysematous. However, electrocautery cutting in intersegmental division might not be suitable for uniportal approach because electrocautery cutting requires countertraction which is difficult to perform in uniportal approach. Therefore, we usually use staplers to divide intersegmental plane in uniportal pulmonary segmentectomy even if the lung is not emphysematous.

We finally show the video describing uniportal thoracoscopic S<sup>9+10</sup> segmentectomy in our institution (*Video 1*).

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