Editorial

Robotic lobectomy has the greatest benefit in patients with marginal pulmonary function

Monica Casiraghi[1], Lorenzo Spaggiari[1,2]

[1]Division of Thoracic Surgery, European Institute of Oncology, [2]Department of Oncology and Hemato-oncology, University of Milan, Milan, Italy

Correspondence to: Dr. Monica Casiraghi. Division of Thoracic Surgery, European Institute of Oncology, Via G. Ripamonti, 435 20141 Milan, Italy. Email: monica.casiraghi@ieo.it.

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Chronic obstructive pulmonary disease (COPD) is one of the most common co-existing comorbidities in primary lung cancer patients, and it is often associated to other cardio-respiratory disease, due to the same smoking habit, posing those patients to higher risk of post-operative complications.

Considering that COPD is associated with a threefold risk of developing primary lung cancer (1,2), it is undeniable that many patients with lung cancer have an impaired respiratory function, which could negatively affect the surgical approach (surgery *vs.* radiotherapy) to avoid the risk of respiratory complications.

It has already been demonstrated in the literature that the incidence of pulmonary complications, in particular pneumonia, was significantly higher up to 25% in the COPD group than in the non-COPD patients, as well as the post-operative mortality (3-5).

However, minimally invasive surgery such as video-assisted thoracic surgery (VATS) and robotic-assisted thoracic surgery (RATS) could play an important role in this "marginal patients" interfering as little as possible with their respiratory function, and then improving their post-operative outcomes.

So far different large-scale studies have demonstrated the benefit of VATS (6-12) and RATS (13,14) lobectomy compared to open lobectomy in terms of less post-operative pain, lower incidence of perioperative morbidity, chest tube duration, and length of stay. These advantages of the minimally invasive surgery were even more significant in high-risk respiratory patients such as CODP patients or obese in which the chest wall trauma due to thoracotomy and the subsequently weakened respiratory mechanic could induce an increase of respiratory postoperative complications. In fact, these "extreme patients" could benefit from the minimally invasive approach, which determines a quicker recovery time and a decreased hospital stay compared with the thoracotomy approach.

In 2012, Ceppa *et al.* published one of the largest retrospective series (the Society of Thoracic Surgeons database), and he compared patients (n=4,531) undergoing VATS lobectomy with patients who had thoracotomy approach (n=8,431), showing that open surgery was associated with a larger overall complication rate than VATS (21.1% *vs.* 17.8%; P<0.0001), in particular in patient with poor pulmonary function (ppoFEV1 <60%) (15).

Besides, Oparka *et al.* reviewed different retrospective studies confirming that patients with marginal pulmonary function tend to have better outcomes after VATS than traditional thoracotomy (16).

Although there are already numerous studies regarding the benefit of VATS approach in patients with limited respiratory function, there are no studies on RATS in these high-risk patients yet, except the one recently published by Kneuertz *et al.* (17). This could be related to the fact that many thoracic surgeons have preferred to exclude high-risk patients, with extremely fragile parenchyma and impaired respiratory function, in particular at the beginning of their experience with a new surgical device to avoid major perioperative complications.

Kent *et al.* published a large-scale review of the National

Database comparing open (n=20,238), VATS (n=12,427) and RATS (n=430) procedures (13), and showed that RATS was associated with decreased mortality, length of stay, and overall post-operative complications when compared with open thoracotomy (statistically significant) and with VATS (not statistically significant); moreover, COPD patients were more prevalent in the RATS group than the VATS group (50% *vs.* 43%, P=0.005) (13).

Even Kneuertz *et al.* showed in his study a reduction of overall complications of 11% using RATS compared with open surgery; in particular, prolonged air leak occurred in only 5% of RATS group patients instead of 15% of the thoracotomy group (17).

In our recent study (18) of 339 RATS anatomical pulmonary resection we showed an incidence of 12.1% of prolonged air leak, which was higher compared to Kneuertz *et al.* data but in line with other robotic lung resection studies which showed rates of prolonged air leak ranging from 4–23% (19). This was probably related to the fact that RATS in our Division was often performed by trained surgeon with their respective learning curve, over the past 10 years, highlighting the importance of an experienced surgeon to approach such high-risk patients.

As Kneuertz *et al.* has already pointed out, despite the absence of the tactile feedback during RATS, the experience of the surgeon and the use of particular measures, such as the use of small gauze during fissure dissection and a careful manipulation of the lung could reduce the risk of pulmonary damage and the consequent air leak, improving the perioperative outcomes (17). These good results could be due to the fact that the surgeon is more careful touching the lung when he does not have a tactile feedback but also thanks to a better three-dimensional view of the robotic system compared to VATS. Besides, the recent introduction of robotic stapler (EndoWrist Stapler) (20,21), directly controlled by the surgeon and with a fully wristed articulation, definitely improved the performance of fissure division due to the better maneuverability of the device inside the thorax with less risk of pulmonary lesions.

In conclusion, the high-risk patients with marginal pulmonary function should not be excluded from robotic surgery, but they should be referred for RATS considering the fewer incidences of post-operative morbidity, and to speed up the recovery of their respiratory function.

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Footnote

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

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