



Pros-cons debate about the role and evolution of triportal video-assisted thoracic surgery (VATS)

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Abstract: Recent advances in the field of minimally invasive surgery for the treatment of lung cancer and, in particular, the emergence of the uniportal approach alongside the more “traditional” multiportal approach, have generated an interesting debate. Supporters of the two different techniques have been on the field with the intent of trying to determine what is the best approach to offer to their patients to guarantee them, not only the best technical result, but above all the lower functional impact and effective oncological results. This article explores the necessary and rigorous scientific path to be followed to ensure adequate clinical trials to support one or the other technique to try to reach an objective conclusion of the current debate.

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Introduction

Surgery remains the cornerstone of lung cancer treatment and (1) video-assisted thoracoscopic surgery (VATS) has been shown to be associated with superior perioperative outcomes when compared to open thoracotomy: numerous meta-analyses have demonstrated reduction of complication rates, shorter hospital-stay and improvement in long-term survival (2-4).

In recent years we observed the emergence of technical innovations in the field of minimally invasive surgery that have improved the minimally invasiveness of the original technique proposed by Roviario in 1992, and increased the number of VATS approaches to pulmonary lobectomy which nowadays differ not only in number and location of ports but also in different approaches to the pulmonary hilum and to the fissure. These factors are the basis of a lively debate. In particular, a strong dualism is emerging between supporters of the so called “standard” (or multiportal) VATS lobectomy and the “younger” and

emerging uniportal VATS technique.

Proponents of the uniportal VATS lobectomy suggest the potential benefits of this approach according to a simple logic sequence: if the conventional multiport VATS is superior to open thoracotomy because it minimize the surgical trauma to the intercostal space (no rib spreading) (5,6), a further reduction in number of ports should further reduce the intercostal trauma and produce even greater benefits. As a result, reducing the number of access to just one, should, in theory, lead to:

- ❖ Less pain, paraesthesia, and morbidity (7-9);
- ❖ Faster recovery (7,10).

Furthermore, it was explained that the display geometries from the uniportal VATS allow a more ergonomic and natural approach for the surgeon. On the other hand, the opponents of this approach point to the technical challenge of using all the instrumentation through the same access and next to the video-thoracoscope (11): this inevitable crowding leads to a reduction of the dexterity and manoeuvrability of the instruments, so that the surgeon

could suffer from a reduced effectiveness of the surgical gesture. In such a situation, opponents fear for:

- ❖ Patient safety;
- ❖ Oncologic adequacy.

If such basic principles of good surgery are not completely adhered to, then the approach should not be performed regardless of any presumed benefits.

Today, there is no doubt that multiportal standard VATS lobectomy is a central element in lung cancer management. It is considered by almost all international guidelines as a gold standard treatment for lung cancer at early stage (12). The transition from the traditional open thoracotomy approach to the alternative VATS minimally invasive approach has been long and troubled, and the debate was concentrated on the most difficult battlefield of clinical trials.

An incessant clinical research has been conducted in the last two decades by analyzing the use of VATS for lung cancer treatment, at the beginning on simple and anecdotal cases or single institutional series and then on large multi-institutional series and national database dataset (10,13).

We can schematically distinguish the evidence supporting the standard multiportal as gold standard for the treatment of lung cancer in four distinct categories:

- (I) Safety;
- (II) Clear benefits;
- (III) Efficacy;
- (IV) Sustainability.

Safety

Do not damage patients: this is the first and most important rule you have to follow when introducing a new surgical technique. Several large case series first described safety and effectiveness of multi-portal approach to VATS lobectomy and the dissemination of such studies in the thoracic community, helped the multiportal technique and its results to be well known and widely accepted as a safe technical innovation (14-17). At the same time the easy reproducibility of VATS multiportal technique facilitated its fast spread worldwide (18). Despite the consistent and gradual growth and diffusion of the last few years, the uniportal VATS technique still seems far from undermining the role of leader of the minimally invasive techniques for the surgical treatment of lung cancer, still a prerogative of the multiportal technique. The lack of reliable data on the spread of the uniportal approach and the absence of comparative manuscripts between the two techniques, do not allow us to really quantify their use among thoracic

surgeons: however, from an analysis of the literature, we can easily deduce that the multiportal technique is still the most adopted, especially in the treatment of early stage lung cancer. The Italian experience confirms this trend also: the data present in the Italian VATS lobectomy registry, which gathers prospectively data from 54 accredited centres, more than 7,400 patients registered from 1 January 2014 till now (www.vatsgroup.org), confirm the surgeon's tendency to mainly use multiportal approach (about 88% of cases), reserving only 9% for the uniportal approach.

Clear benefits

The second step in VATS lobectomy journey was the comparison between VATS and thoracotomy in lung cancer treatment. The main outcomes used to prove the supremacy of minimally invasive technique were: pain, morbidity, recovery time. The advantages of the multiportal VATS approach over the standard open technique was demonstrated through retrospective studies comparing on large series the two techniques (19). The same results were accomplished by more complex studies such as case-matched series (20). As a whole, the results of these studies clearly stated that multiportal VATS lobectomy was linked with better results than the traditional open approach: less pain, shorter hospital stay, faster recovery to the normal function, early availability for adjuvant therapies.

Unfortunately, the attempts for large randomized studies were not successful (21). Nowadays, the body of evidence accumulated in literature about the benefits of VATS lobectomy for early stage NSCLC compared to open thoracotomy, have made future randomized trials not only improbable but also ethically dubious to be accepted (22). Using the same methods, if we compare the multiportal and the uniportal VATS technique, we cannot find clear evidence that by reducing the number of ports we achieve better results in terms of intra-operative and post-operative outcomes. Only few papers analyzing single institution series compare the two techniques (multiportal versus uniportal). In this scenario, the tool of prospective clinical trials should be the most suitable to answer the question.

Efficacy

Once the benefits of the new VATS technique have been demonstrated, its use cannot yet be justified until it is clear that the outcomes of the minimally invasive treatment are equivalent to those obtained with open surgery: this

means evaluating the efficacy of the treatment in terms of completeness of the resection, in particular the adequacy of lymph node dissection and overall survival.

Different comparative studies (23-25) have effectively showed the equivalence of the two treatments about nodal dissection and long-term survival. In the last 10 years a series of systematic reviews and meta-analyses comparing lung cancer survival between the VATS and open approaches (3,26,27) have been performed, allowing the analysis of a large volume of data and showing not only the equivalence of VATS approach compared to open thoracotomy, but also that VATS could even be marginally superior in terms of survival for early-stage disease.

Obviously, survival analysis requires a long follow-up period (at least 10 years) and the need for a sufficient accumulation of case series data made the meta-analyses not available until recent years.

At the end, the evidence of the VATS effectiveness led to acceptance of this new approach by the scientific community as an alternative to open thoracotomy, mentioning VATS as a preferred technique when “compared to a thoracotomy for anatomical pulmonary resection” in stage I lung cancer (21).

On the other side, the advantages of uniportal VATS on standard multiportal VATS in terms of treatment efficacy remains unclear.

The most evaluated parameter is the number of dissected lymph nodes which is clearly not exhaustive.

This parameter has been analyzed in few comparative studies, none of which showing a superiority of one technique over the other in terms of number of dissected lymph nodes. Only two of these works (both from the same authors) showed the superior performance of the uniportal approach (28,29): obviously this isolated datum cannot be considered a body of evidence.

However, as already stated, the main evaluation of the effectiveness of a surgical oncological treatment must be performed through the long-term survival analysis.

None of the studies published so far focused on this kind of result: since the first uniportal VATS for lung cancer was performed in 2011, we can consider this lack of data as a normal consequence of a still too short follow-up.

Sustainability

If we look to the economic aspects, several studies have shown the VATS lobectomy as economically sustainable, particularly after the learning curve period, which usually appears of rapid completion, allowing a constant transfer of

knowledge from one generation of thoracic surgeons to the next (30,31).

In this field, with regard to the uniportal VATS approach, there is still lack of clear evidence on how to structure and standardize specific training paths able to lead the VATS surgeon to the routinely use of the uniportal VATS approach. Even if in the last years a lot of uniportal VATS courses have become very common worldwide, it is a “real world” experience that a minimally invasive approach (almost) always begins with a standard three or two ports approach, and then only in selected cases (and after a period longer than the standard learning curve) becomes uniportal.

Conclusions

The debate about the multiportal versus the uniportal VATS approach cannot be resolved at the moment. What we know is that the multiportal VATS approach and its journey towards the gold standard of lung cancer treatment, especially at an early stage, showed us that perseverance, patience and plenty of time are needed to produce the clinical data needed to adopt an innovative surgical technique. As with other innovations, uniportal VATS needs to find its own role through a full rigorous scientific scrutiny. At the present time, nobody can say if we create most surgical trauma with several instruments through one incision or with several small incisions with one instrument in each. The patient safety must emerge as the winner of this debate, which can only be resolved through the production of solid clinical trials, to clearly show data in favour of one of the two VATS techniques.

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