Introduction

Video-assisted thoracic surgery (VATS) has meant an important change in the postoperative period of patients undergoing thoracic surgery (1,2). In recent years, the uniportal VATS approach has become the routine approach in numerous centers (3), even in complex procedures such as sleeve resections (4) or anatomical segmentectomies (5). Uniportal VATS potentially attacks to a single intercostal space reducing pain and improving postoperative outcomes (6). Uniportal VATS learning curve is a challenge even for those surgeons with experience in multiportal VATS surgery (3). We describe our routine programme of VATS assisted by articulated arm (AVATS) for major resections, as a technique that allows ergonomic surgery for both, surgeon and first assistant.

Operative technique

The concept of AVATS surgery is to attend VATS with and articulated arm that holds the 30° camera and allows ergonomic field of operation. There are several available systems (mechanic, pneumatic, or voice-controlled) (7). System consists of three point of articulation with a rotation of 180 degrees that is anchored to the surgical table (Figure 1A).

During AVATS, the surgical approach is performed as in routine VATS. For upper pulmonary major procedures, the articulated arm is usually located on the same side of the first surgeon, anchoring its main stem at the height of the anterior superior iliac spine (ASIS) (Figure 1A). For lower procedures, the articulated arm can be placed on the side of the main surgeon, as well as on the opposite side, at the height of the utility incision (Figure 1B), depending on the preferences of the surgeon. For major mediastinal surgery, the arm is usually place in the same side than surgeon, near to the ASIS and is facilitated by CO2 collapse and is quite ergonomic with 3 ports approach (Figure 1C).

In major pulmonary resections, the position (both height
and rotation) of the main stem is modifiable whenever necessary, although usually it is enough with the fine adjustments made by the assistant on the 3 joints (Figure 2). In all cases, the adjustment of the articulated arm does not interfere with the usual handling of the 30 degree optics, allowing to modify the degrees whenever the assistant needs it. In pneumatic arm case, the movement is activated by a button that activates the pneumatic system connected to the nitrogen intake. The release of the assistant allows complex instrumentation through the VATS approach (uni or multiportal), making it possible for the assistant to also use both hands to help the main surgeon (Figure 3).

In experienced teams, almost every AVATS can be developed through unisurgeon technique (7). As during AVATS the surgeon is not fighting for space with the assistant, the position is more comfortable than in conventional VATS and more exigent situations as strong adhesions or systematic lymphadenectomy can be done through more ergonomic way (Figure 4A). In case of uniportal VATS approach, some interesting tricks as two instruments handed trick, self-holding instrument trick, two finger instrumentation trick and surgeon-assistant two handed advance instrumentation (Figure 4B) can facilitate the procedure.

In our initial experience, surgical time and perioperative complications are not affected by this approach. In addition, our activity was developed in its majority through uniportal AVATS, having appreciated greater fluidity and speed in the surgery since the assistant can collaborate actively in the procedure, comparing to conventional uniportal VATS.

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**Figure 1** Ergonomic positions during AVATS major resections. (A) AVATS system position for major upper pulmonary resections; (B) uniportal AVATS approach for major lower pulmonary resections; (C) AVATS approach for major mediastinal surgery. AVATS, VATS surgery assisted by articulated arm.

**Figure 2** Camera adjustment in AVATS left lower lobectomy (8). AVATS, VATS surgery assisted by articulated arm. Available online: http://www.asvide.com/article/view/30029

**Figure 3** AVATS left lower lobectomy (9). AVATS, VATS surgery assisted by articulated arm. Available online: http://www.asvide.com/article/view/30030

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The uniportal VATS major procedures of high complexity (lobectomies, anatomical segmentectomies or extended procedures with bronchoplasty or angioplasty) were perceived by our assistants with a value 8–10 (really hard or maximum effort) on the Borg CR-10 Scale, whereas during the use of the AVATS system are perceived at a level 1–2 (really easy or easy).

Comments

Ergonomic problems during VATS surgery have been previously described in the literature. Main problems remain in the fatigue of the legs, a static body position, a large working area and extreme movements of the upper limbs (10). Even more, through Uniportal VATS, the assistant have the challenge to ensure the quality of the image, assist the main surgeon and keep the camera straight simultaneously. It is well known that fatigue caused by holding the camera for a long time reduces the attention of the assistant and increases the uncertainty of the surgery (11). These ergonomics problems can be resolved following AVATS system, so the assistant remains free to be involved in the procedure, increasing attention, an active participation. In addition, AVATS system allows a completely immobile image, what sometimes is very difficult under conventional uniportal or multiportal VATS. The ergonomic benefit of the uniportal VATS compared to the multiportal approach has been evaluated in less complex procedures such as wedge-type resections (12,13). This benefit is justified by viewing direction allowing better eye-hand-target axis and a posture that overload trapezius muscles instead of biceps flexion what minimized the fatigue (13). However, it is noteworthy that the main ergonomic problems of the uniportal VATS approach appears in procedures of longer duration and complexity (lobectomy, anatomical segmentectomy, major mediastinal resections), is difficult to keep the posture during the time without compromising the assistantship. Uniportal VATS major resections, due to the complexity and duration, are the context that most benefits from the AVATS system. A key point is that in uniportal AVATS procedures, eye-hand-target axis is well maintained but also is possible to avoid muscle overloading.

Conclusions

AVATS surgery increase ergonomics and optimization of surgical resources and is a very good tool to create more cooperation between surgeon and assistant. As the technique is just developed since less than 1 year, prospective studies are needed to assess economy and influence in the intraoperative complications, but in our experience, is a safe and feasible technique for surgeon who previously has already completed VATS learning curve.

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None.

Footnote

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

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References


