

From RATS to VATS: why we did choose this way

Thomas Schmid, Florian Augustin

Department of Visceral, Transplant and Thoracic Surgery, Center of Operative Medicine, Innsbruck Medical University, Innsbruck, Austria

Correspondence to: Florian Augustin, MD. Department of Visceral, Transplant and Thoracic Surgery, Center of Operative Medicine, Innsbruck Medical University, Anichstrasse 35, 6020 Innsbruck, Austria. Email: florian.augustin@i-med.ac.at.

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Minimally invasive thoracic surgery has become standard in many centers over the last years. While surgeons agree on the benefits like less pain, shorter hospital stay and faster rehabilitation, there is an ongoing debate about the best minimally invasive approach. Besides the number and size of incisions (multiport, uniportal, etc.), the question of the optimal platform became more and more important. To date there is no clear evidence about the superiority of a robotic or conventional video-assisted thoracoscopic surgery (VATS) approach. In the following, we share our experience and the reasons why we switched from robotics to VATS technique for anatomical lung resections. Nevertheless, even for convinced conventional VATS surgeons like ourselves, we believe in the robot as a useful tool in the future and even think that it might be superior to conventional VATS in some circumstances.

Back in the early 2000s, the University Hospital of Innsbruck, Austria, was one of the first institutions in Europe to acquire the da Vinci Robotic System. Fascinated by the technology, we did perform our first robotic assisted thoracic surgery (RATS) procedures in 2001. The surgical technique was in its infancy and at our institution more or less self-taught. There was little to no literature about the best set-up, approach or operative steps. At that time, the robot did not offer the various instruments that are available and standard today. And still, the technique was promising. In the beginning, we simply mimicked an open posterior technique which back then was our standard open procedure. Overall, the robotic procedures were cumbersome and demanding, resulting in long operative times and dissatisfaction of all team members. Only with some delay, the topic of RATS was debated at international conferences and it occurred to us that an anterior approach might offer some benefits. Applying this and the fissure last principle, we immediately experienced a smoother flow of

the whole procedure. Even though most of the perceived advantages were hard to demonstrate, it resulted in a statistically significant reduction of operating times (1).

During the time of our RATS program we did also encounter further drawbacks. The primary focus of the company behind the robotic system was on cardiac surgery, which led to a lack of specific instruments (above all stapling devices) and only little support was given to share experience or get dedicated training. Moreover, critics started to point at the substantial additional costs compared to open surgery with no proven oncologic benefit. On the contrary, more and more evidence was available showing the benefits of the conventional VATS approach for minimally invasive anatomic lung resections. Techniques rapidly became standardized (anterior vs. posterior approach, 3 ports in general). Educational material (online videos) and also hands-on courses were available, and companies were interested that the knowledge about VATS lobectomies was distributed.

Out of all these reasons, we gave the conventional VATS approach a try. In February 2009, we did perform our first VATS lobectomy. The procedure went very well, operative time was shorter than any of the robotic cases, the patient recovered quickly with only little pain, and everyone was happy. The technique was so convincing that we did not even think about switching back to robotics:

- ❖ No cumbersome set-up (diminishing the resistance of technical OR staff);
- ❖ Every instrument designed to meet the needs of a minimally invasive surgeon;
- ❖ Luckily also low complication and low conversion rates (lower than with the robotic approach);
- ❖ Due to its feasibility also a broader application of the VATS technique that built up experience faster than with the robotic approach.



Figure 1 Bronchial anastomosis using the da Vinci robotic system (4).

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To scientifically evaluate the differences between the two approaches, we did compare our series and found a significantly shorter operative time (215 *vs.* 183 min), less blood loss and significantly lower procedural costs (44.4%) in favor of the VATS approach (2). With no evident perioperative or oncologic benefit of the RATS approach, we found that VATS was the way to go on until today and every early stage lung cancer at our institution was scheduled as a VATS procedure since then.

We do acknowledge advantages of the robotic system, like direct hand-eye-coordination and therefore better ergonomics. Especially the advanced maneuverability with seven degrees of freedom is one particular thing that we miss in conventional VATS. Even though bronchoplastic resections can be performed using VATS approach, the benefits of articulating instruments become evident in these complex procedures (3). We did perform a hybrid procedure in a patient with a centrally located carcinoid tumor, where we completed the resection of the bronchial sleeve by means of conventional VATS and then performed the bronchial anastomosis with the da Vinci robot (*Figure 1*) (5). We do think that these difficult procedures might be an ideal field of application of the robotic platform in the future.

If a surgeon is able to perform both techniques equally well, there are other things to consider, like shorter hospital stay, less pain, smaller incisions, and better cosmetics. Whether in any of these matters a robotic approach is superior to a conventional VATS approach remains to be seen. To date, there are no convincing results showing

a clear benefit as we still lack appropriately powered randomized controlled trials.

At this point, using the robot means spending financial resources that society has to be willing to spend. Maybe in the future, as it happened with personal computers, we will see a more affordable technology and a faster improvement of the technology as more companies step into this field. There are robotic systems in the pipeline of medical technology companies, which will increase competition in the market and thus might lead to advantages for both, patients and surgeons.

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Footnote

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

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