Editorial

Prevention is better than cure!

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The development of video-assisted thoracoscopic surgery (VATS) in the treatment of lung cancer allowed to reduce morbidity related to thoracotomy approach. In case in which the tumor invades the hilum directly or in case of hilar (N1) nodal disease it may be extremely difficult or dangerous to accomplish a radical resection by thoracoscopic approach due to some technical limitations. In the past, this situation was considered an absolute contraindication to thoracoscopic approach, being the risk of major complications high; however, recent studies have demonstrated the feasibility of resection extended to the vessels (1). In particular, when a nodal involvement at the level of the origin of pulmonary artery branches for the lobe is present, or in case of hilar calcification or granulomatous inflammation, the risk of sudden bleeding during dissection due to vascular lesion is high and an emergency thoracotomy is required (2). When a major bleeding occurs during thoracoscopic lobectomy the risk of mortality is high or the need for an unplanned major pulmonary resection is frequent (3,4). This raises the question of whether it is indicated or not to prevent any major bleeding by applying intraoperative maneuvers in order to better control the vessels. In a recent article, Liu *et al.* (5) report a series of techniques aiming to troubleshoot complicated hilar anatomy due to tumor invasion, lymphadenopathy, calcification, charring and dense inflammatory adhesions raising the indication for each technique according to different situations. The rationale is to avoid any vascular damage and consequent major bleeding during VATS lobectomy, by a prophylactic clamping of the pulmonary artery.

As underlined by Liu *et al.*, it is important to select an appropriate technique in case of complicated hilum; in fact, the pulmonary vascular system, differently from systemic vessels, has a low pressure and the vascular arterial wall is very thin and vulnerable. Therefore, also small lesions of the pulmonary artery during dissection may increase longitudinally and proximally leading to critical lacerations. Moreover, vascular dissection in the pulmonary anatomy may be further complicated by lymph-nodes strictly adherent or infiltrating the vascular wall. Thus, every time a technical difficulty is provided during pulmonary vessels dissection, it is advisable to isolate the main pulmonary artery around a tourniquet; in case of bleeding, in fact, the prompt closure of the tourniquet or the direct clamping avoids a big blood flow (6). The authors (5) describe three techniques used in the course of VATS lobectomy complicated by inflammatory adhesions and charred lymph nodes at the hilum. In case of insufficient space for the dissection or direct ligation of the arterial branches it is possible to proceed to their section and suture, after a prophylactic clamping of the proximal trunk of the pulmonary artery using a removable clamp. If the branch of the artery involved can not be resected and the pulmonary arterial trunk is not affected, it is possible to perform the section and suture of the branch by means of endo-stapler directly and simultaneous angioplasty with partial removal of the pulmonary artery trunk, after proximal clamping, not observing the authors, any stenosis after angioplasty. In the involvement of both the branch of the pulmonary artery and of part of the trunk, it proceeds to clamp the artery upstream and downstream with subsequent partial removal of the portion of the trunk of the pulmonary artery involved. After washing with diluted heparin, angioplasty

by continuous suture of the vessel is performed followed by distal (to allow air to escape), and then proximal declamping.

Although the VATS technique is widely used and accepted, up to now few attempts at more complex VATS procedures have been described. In terms of pulmonary artery reconstruction, Nakanishi *et al.* (7) described their practical experience in partial pulmonary artery removal in VATS. Based on Nakanishi's initial experience, Xu *et al.* (8) presented a retrospective study of seven patients who underwent VATS lobectomy. The authors describe an innovative technique for the partial removal of the pulmonary artery after clamping of the artery and pulmonary vein using a Satinsky clamp to block the pulmonary artery trunk and clamp the pulmonary vein with a tape (tourniquet) secured with a Hem-o-lock clip. This technique allows a clearer view of the operative field and a reduction of blood loss, in the absence of changes in blood flow through the reconstructed pulmonary artery.

As described in the study by Nakanishi *et al.* (7), it is important for a surgeon to obtain sufficient exposure of the pulmonary artery trunk, obtain proximal and distal control of the pulmonary artery, manage the instruments properly and finally complete the sutures. The technical difficulties and the objectives to be pursued are those of obtaining the control of the bleeding, spaces for technical maneuvering (the clamping of the distal pulmonary vein improves the vision of the operative field, increases the space, simplifies the procedures and allows to obtain security on the margins), avoiding ischemia/reperfusion injury after clamping (tolerated and reversible times within one hour of artery and pulmonary vein blockage), managing anticoagulant therapy (8). Other technical difficulties related to the resection and reconstruction of the pulmonary artery are reported by Xu *et al.* (8) which ensure a safe thoracoscopic resection without bleeding margins and, ensure oncologically negative margins maintaining a sufficient vascular caliber for blood flow.

With regard to the first technical problem, in thoracoscopic lobectomy the mechanical staplers allow today, safe sutures obviating the problem of small bleeding. For the reduction of the arterial vascular caliber, if the narrowing is not more than one third of the original lumen of the pulmonary trunk, the blood supply from the pulmonary artery will not be compromised.

Performing a VATS lobectomy in patients with severe hilar adhesions or intraoperative bleeding is very risky and makes it difficult to control the sudden bleeding. In this case the VATS approach is converted into thoracotomy if there is no prior pulmonary artery blocking system. The knowledge of different techniques of arterial trunk control, using clamps, suture threads, or tourniquet, allows the surgeon to avoid lesions of the arterial wall and to effectively manage a possible vascular rupture (9). As underlined by Nakanishi *et al.* (7), to assure the safety and reliability in the performance of a resection and reconstruction of the PA using the VATS procedure, the surgeon must achieve sufficient access to the main PA, gain proximal and distal control of the PA, properly manage the instruments and sutures, and also appropriately address the problem of anticoagulation therapy. The availability of new specific instruments such as endoscopic bulldog clamps (6) has permitted a safer and easier pulmonary artery control also allowing an increased space to perform thoracoscopic dissection and resection.

In conclusion, a VATS lobectomy that includes pulmonary artery control and eventually resection and reconstruction is a feasible and safe surgical mode when technical problems can be dealt with appropriately, even if it remains a complex procedure.

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Footnote

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

References

1. Xu K, Zhang Z, Zhao J, et al. Partial removal of the pulmonary artery in video-assisted thoracic surgery for non-small cell lung cancer. J Biomed Res 2013;27:310-7.
2. Samson P, Guitron J, Reed MF, et al. Predictors of conversion to thoracotomy for video-assisted thoracoscopic lobectomy: a retrospective analysis and the influence of computed tomography-based calcification assessment. J Thorac Cardiovasc Surg 2013;145:1512-8.
3. Decaluwe H, Petersen RH, Hansen H, et al. Major intraoperative complications during video-assisted thoracoscopic anatomical lung resections: an intention-to-treat analysis. Eur J Cardiothorac Surg 2015;48:588-98; discussion 599.
4. Flores RM, Ihekweazu U, Dycoco J, et al. Video-assisted

thoracoscopic surgery (VATS) lobectomy: catastrophic intraoperative complications. J Thorac Cardiovasc Surg 2011;142:1412-7.
5. Liu C, Ma L, Pu Q, et al. Troubleshooting complicated hilar anatomy via prophylactically clamping the pulmonary artery: three videos demonstrating three techniques. Ann Transl Med 2018;6:365.
6. Dong YN, Sun N, Ren Y, et al. Thoracoscopic left upper lobectomy with systematic lymph nodes dissection under left pulmonary artery clamping. J Thorac Dis 2014;6:1855-60.
7. Nakanishi R, Yamashita T, Oka S. Initial experience of video-assisted thoracic surgery lobectomy with partial removal of the pulmonary artery. Interact Cardiovasc Thorac Surg 2008;7:996-1000.
8. Xu X, Huang J, Yin W, et al. Pulmonary arterioplasty using video-assisted thoracic surgery mechanical suture technique. J Thorac Dis 2016;8:617-27.
9. Watanabe A, Koyanagi T, Nakashima S, et al. How to clamp the main pulmonary artery during video-assisted thoracoscopic surgery lobectomy. Eur J Cardiothorac Surg 2007;31:129-31.

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