



# Vascular injuries during VATS lobectomies: keep calm, compress and have a plan

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*“Everything is unprecedented until it happens for the first time”.*  
—Chesley ‘Sully’ Sullenberger

Nowadays video-assisted thoracic surgery (VATS) lobectomy is the standard surgical modality for early-stage non-small cell lung cancer (NSCLC) and has been gradually applied also to more advanced stages of lung cancer. A lobectomy requires the interruption of significant structures, including branches of the pulmonary artery, pulmonary vein, and bronchus. As for the thoracotomy, this technique had not changed since 1940 when individual hilar dissection was first performed (1). The pivotal role of VATS lobectomy has been extensively explored evidencing the decreased morbidity, the better quality of life and the reduced hospital length of stay, with similar survival rates (2). The penetrance of this technique has been somewhat slow in the last 25 years in the thoracic surgeon community, due to many reasons and including the fear of major intraoperative complications (3). The vascular injury was an obstruction to the acceptance of VATS in lung surgery. Injuries to vascular structures might be uncontrollable and call for an emergency and unplanned conversion or, worse, might necessitate major pulmonary resections (4). However, there was no adequate solution, and the information reported afterwards is still rare, except the conversion to open thoracotomy. Intraoperative management for bleeding from a significant pulmonary arterial branch injury referred to the Cerfolio’s rule of the four “P”: poise; pressure to apply immediately to the bleeding vessel; preoperatively preparedness of a disaster plan (not rush preparation of thoracotomy after the injury); proximal control of the vessel

bleeding (5).

In their recently published paper, Chenglin Guo *et al.* from the West China Hospital, Sichuan University of Chengdu (CN), presented the details of suction—compressing angiography technique for vascular injury repair during VATS lobectomies. After the control of the bleeding with the compression of the injured site with the suction tip, the vascular repair could be divided into three different approaches according to the location and size of the vascular injury (6). Nevertheless, this technique is not suitable for the injuries of the main pulmonary artery when there is not enough space to block the proximal artery (6).

Despite pulmonary artery bleeding is considered among the most feared situations during hilar VATS dissection, the related risk factors and the direct consequences of these vascular injuries are challenging to study. On the other hand, this issue is not widely covered in the medical literature. The incidence of vascular damages reported by large volume centres and by skilled surgeons is slight (7), and reports of intra-operative catastrophes, including death, caused by uncontrolled bleeding in high-volume centres are also negligible. However, the incidence of vascular injuries across the spectrum of surgical experience is likely to be higher. The occurrence of vascular incidents (or complications that result from vascular injuries during VATS lobectomy) is possible under-reported (8). An analysis of the vascular injuries among a vast population coming from the European Society of Thoracic Surgeons (ESTS) database found an incidence of 2.9% (9); other authors reported a range of unplanned thoracotomy due to bleeding

from 0.5% to 5.2% (8), or from 4.1% (10) to 8.2% (11). It might be noted otherwise that while most of the vascular injuries are related to a challenging and hazardous vessel dissection, stapler failure is only anecdotic, and most of the stapler malfunctions could be related to human mistakes in handling and appropriately manipulating vessels (12). Therefore, the literature evidence is not homogeneous, and the comparison of different surgical approaches is difficult. For example, it is well accepted that hilar adhesions due to lymphadenopathy are responsible for most of the vascular injuries requiring an unplanned thoracotomy (10,13-15) and that skilled surgeons could move beyond the boundaries to a more aggressive lymph nodes dissection (13). Nevertheless, only a minority of potential conversion due to complicated hilar preparation are predictable preoperatively on a preoperative chest computed tomography (2). The primary concerns for vascular injuries are the possible increased risk of morbidity and mortality due to longer operating time, further lung manipulation, an increased risk of damage to adjacent tissues and an increased blood loss.

Patient safety must remain the primary focus and conversion should be discussed at any time when patient safety is not guaranteed. Conversion should be considered more a resource to preserve patient's safety rather than the failure of the VATS approach. Therefore, the correct assessment of any bleeding is of paramount importance during every VATS procedure (16). Delayed conversion and an unsuccessful attempt to manage complications with minimally invasive techniques increase the risk of unfortunate intraoperative events (17).

In conclusion, the occurrence of vascular injury is inevitable, but a well-trained surgical team can treat it appropriately. The decision regarding repair by VATS or the conversion to thoracotomy depends on many factors as the severity of the vascular injury, the surgeons' experience, the anesthesiologist and nursing staff's cooperation and so on (18). However, one strategy should guide us: keep calm, compress the bleeding site directly and have an organised disaster plan.

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## Footnote

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

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