How to deal with benign hilar or interlobar lymphadenopathy during video-assisted thoracic surgery lobectomy—case report series

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Lymphadenopathy is commonly encountered in thoracic surgery, and can present a spectrum of challenges to the surgeon and operating team. In what follows, we provide our approach to lymph nodes that complicate video-assisted lobectomy.

Surgical resection remains the cornerstone of treatment for early and locally advanced non-small cell lung cancer (NSCLC). Video-assisted thoracic surgery (VATS) has revolutionized surgical strategies for lung cancer by decreasing the immune response to tissue trauma, diminishing postoperative pain, decreasing perioperative hospitalization and morbidity, enhancing functional recovery compared to traditional thoracotomy. In addition to these well-studied benefits, VATS also allows for clear and high-definition projection of vascular structures and lymph node basins.

The lymphatic drainage of the lungs is accomplished through several inter-connecting networks of lymph nodes, which course through the lungs parallel and closely associated to the pulmonary vasculature. This predictable characteristic can aid identification of pulmonary arterial branch points, as lymph nodes are commonly encountered at such sites. Lymph node evaluation has prognostic implications in lung cancer and malignant lymph nodes are taken with the specimen as part of a sound oncologic operation. This is typically accomplished during VATS lobectomy by sweeping the lymph nodes toward the specimen during dissection of the lobar pulmonary artery branches. However, benign, enlarged lymph nodes can present interesting challenges to the completion of VATS lobectomy. Calcification, adherence to vasculature and adherence to lobar bronchi can all complicate safe dissection and division of these structures.

It has been said that success is where preparation and opportunity meet. Anticipation is a key component in the management of benign lymphadenopathy encountered in VATS lobectomy. Patients in a modern thoracic surgery practice seldom enter the operating room without computed tomography (CT) scans, which are generally quite sensitive for lymphadenopathy. When planning a lobectomy, the CT scans are reviewed carefully by the attending surgeon and assistants prior to surgery. In addition to making a mental mapping of the tumor itself, pulmonary arterial and venous vessels to the corresponding lobe can be followed. Anything out of the ordinary is reviewed with a thoracic radiologist for clarification. Patient imaging is always conspicuously displayed in our operating rooms for the duration of the operation. Additionally, the planned operation, pertinent patient history and preoperative data are always written on a large erasable board, making information such as pulmonary function studies, preoperative hematocrit, or known bleeding diatheses available to the care team throughout the case. In an operating room as busy as ours, staff can change multiple times throughout a single operation, and this assures that important information is consistently available. Also because of operating staff traffic, a separate board also names the members of the operating team for any particular case (Figure 1). This facilitates easy and effective communication.

The preoperative team huddle plays an important role in the preparation of the operating team. During this "timeout" standard information about the patient is conveyed,

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Figure 1 A dry-erase board is completed before each case to delineate members of the operating room team.



Figure 2 Clockwise from the top left are standard for lobectomies: a sponge stick, two dental pledgets, extra-long Judd-Allis forceps and a 3-0 prolene suture on an extra-long needle driver are prepared prior to incision and available on the back table during dissection.

but there is also an opportunity here for the surgeon to express any anticipated and unique challenges. Known or expected lymphadenopathy can be mentioned here. It is also confirmed that typed and cross-matched blood is available and in the room. Anywhere from 2 to 6 units are made available based on the procedure and surgeon preference.



Figure 3 All members of the surgical team are focused on the field for the duration of the procedure.

The surgical scrub plays an important role in preparation at the operating room table. Each VATS lobectomy is prepared not only with instruments for thoracoscopy, but a thoracotomy tray is also opened and readily available. At the beginning of the case, a dental pledget sponge-stick and 3-0 or 4-0 prolene suture on an extra-long needle driver are prepared and available on the back table (*Figure 2*).

Every team member is viewed as a contributor for a VATS lobectomy, and as such, the surgical scrub and assistants do not look away from the operating field unless absolutely necessary (Figure 3). Lymph nodes encountered during dissecting are either removed or swept away from lobar vessels and the lobar bronchus. Stapling these structures with interfering lymph nodes is ill advised, as this can lead to disruption of the staple line, allowing immediate or delayed dehiscence. Prior to stapling lobar veins and arteries, the surgical scrub has a sponge stick or dental pledget in hand. This makes for swift control of any bleeding encountered. The same procedure is completed at the surgeons request if lymph nodes are encountered around major vessels during dissection. Lymph nodes can generally be managed with meticulous dissection in avascular planes. Occasionally, however, entering the capsule of the lymph node cannot be avoided. This often introduces troublesome oozing but does not represent lifethreatening bleeding. Simple pressure or application of a topic agent, such as Surgicel (Ethicon) can provide control without compromising visualization (Figure 4).

It can be easy to get caught up in controlling bleeding

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Figure 4 Dissection of interlobar lymph nodes (1). Here, a VATS lower lobectomy is underway and large bulky lymph node surrounds the basilar pulmonary artery trunk, prohibiting safe passage of the stapler for ligation. The lymph node is excised with careful circumferential dissection, gentle traction, and a combination of blunt and ultrasonic shear dissection. Avoiding entrance into the capsule avoids bleeding from the lymph node itself. Minor bleeding in the lymph node bed is easily identified and controlled with electrocautery. VATS, video-assisted thoracic surgery. Available online: http://www.asvide.com/articles/792



Figure 5 Control of lymph node bleeding (2). Here again a VATS lower lobectomy is underway and bleeding was encountered from a nodal basin following removal of a stapler across the fissure. A piece of Surgicel is applied and reinforced with a dental pledget (always loaded and available in the hands of the surgical scrub when firing the stapler) and then a more robust sponge on a stick. Note a panorama view is kept with the video scope and that the camera remains still. Zooming in can cause tunnel vision when dealing with important bleeding and makes it more likely that the camera can get splashed. Maintaining a consistent view is paramount when dealing with bleeding during VATS lobectomy. The bleeding resolved and the lobectomy was completed without conversion to thoracotomy. VATS, video-assisted thoracic surgery. Available online: http://www.asvide.com/articles/793

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from the lymph node itself during dissection. This often resolves after the lymph node is removed, however, so efforts to continue dissection should be pursued as bleeding usually stops once the lymph nodes have been completely removed. We often use a combination of blunt and energybased dissection when encountering bulky interlobar lymph nodes during lobectomy. The electrocautery, the Ligasure and Harmonic devices are all utilized in our division. Gentle traction and displacing of the associated vessel away from the lymph node can expose any enlarged vessels or lymphatics, which are ligated with the Harmonic (Ethicon) or LigaSure (Covidien) devices (Figure 5). This is done not only to control leakage, but because the vessels and lymphatics often retract after ligation, and finding them after cutting them can be difficult. Benign lymph nodes can often be teased away and sent separately in this fashion, freeing the associated lobar vessels for easy passage of a stapler and ligation. Occasionally, large, granulomatous lymph nodes or bulky calcified lymph nodes cannot safely be maneuvered this way. It is usually possible to get feedback about the plane between the vessel or bronchus and an enlarged lymph node by rubbing the back of an instrument or the suction device gently against the lymph node. If the vessel and lymph node move together and cannot be separated, if the lymph node completely surrounds the vessel or if it seems to encroach or involve the adventitia, more proximal vasculature is needed. In such cases, the right or left main pulmonary artery are dissected and encircled with umbilical tape. The tapes can be cinched down in the event of bleeding. All of this can be accomplished with VATS technique. Encircling main pulmonary artery branches with umbilical tape signals to the surgical scrub and the rest of the team that there is bleeding potential and the appropriate instruments can be quickly inventoried.

Bleeding during lymph node dissection or any other component of the procedure is handled the same way each time. Sponge sticks or dental pledgets are applied with only as much force as is required to tamponade. Excessive force can propagate the tear and bulky lymph nodes can already impair visualization, so it is important to be able to precisely see the tear. Pooled blood is suctioned away from the field while gentle pressure is held. The assistant holding the camera remains still and focused on the bleeding site, removing the camera only when directed if cleaning is needed. Primary repair is often all that is needed for injuries related to lymph node dissection. Figure of eight prolene sutures will often re-approximate the vessel without

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stenosing the lumen. Communication here is key, and this is often a good time for anesthesia to prepare for rapid fluid or blood infusion. If bleeding is not controlled after tightening the umbilical tape around the proximal artery or tamponade with a sponge stick, then conversion to a thoracotomy made be necessary. At least one team member wears a headlight for this purpose during every VATS lobectomy. At our institution, the thoracotomy is standardized and often can be accomplished in just a few minutes with little talking. The camera and sponge stick can be left in place during the thoracotomy to limit blood loss and facilitate positioning of the incision. Once bleeding is controlled, the lobectomy can be completed in the usual fashion.

Bulky adenopathy during lobectomy can present technical challenges to dissection and ligation of lobar pulmonary vessels or dissection of bronchi. We present our operating team's approach to safe completion of lobectomy in these scenarios.

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Footnote

Conflicts of Interest: Dr. Swanson is a consultant for Covidien and Ethicon. Dr. White has no conflicts of interest to declare.

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