Cardiophrenic Lymph Node Resection Through Abdominal Subxiphoid Approach: Surgical Technique

Christian Mouawad, MD, MSc[1]
Surgeon

Rui Bernardino, MD[2]
Surgeon

Chetana Lim MD, PhD[1]
Surgeon

[1]Department of Digestive, Hepatobiliary, and Liver Transplantation Surgery, AP-HP, Hôpital de la Pitié-Salpêtrière, Paris, France
[2]General Surgery Department, Hospital de Santa Maria – Centro Hospitalar Lisboa Norte, Lisbon, Portugal

ABSTRACT

While metastatic extension to the cardiophrenic lymph nodes (CPN) is relatively rare, cardiophrenic lymphadenectomy may be performed for diagnostic and/or therapeutic purposes. The subxiphoid approach is appropriate, especially for CPN in the prepericardiac area, offering adequate exposure while avoiding the morbidity associated with pleural or pericardial breach. In this article, we describe the surgical technique—detailing the retrosternal liberation section of the tranversus abdominis muscle, followed by cardiophrenic dissection and lymphadenectomy.

INTRODUCTION

The cardiophrenic space is the fatty space located at the lower end of the mediastinum. It is frequently enlarged in obese subjects. It may be the site of fatty, cystic, solid, or vascular lesions. The origin of these lesions may be infra- or supra-diaphragmatic, tumoral, inflammatory, congenital, or post-traumatic. The cardio-phrenic space may contain fatty lesions (diaphragmatic hernia with epiploic content, pericardial fat necrosis, thymolipoma), cystic lesions (pleuropericardial cyst), solid lesions (adenopathies), or vascular lesions (varicose veins). Computed tomography (CT) scan can be used to evaluate the morphological characteristics of these lesions.

The lymph nodes of the cardiophrenic mediastinal space comprise the anterior pre-pericardial and latero-pericardial nodes. Their corresponding afferent vessels drain into the internal mammary chain.[1] Metastatic extension to the cardiophrenic lymph nodes (CPN) is relatively rare. The primary tumor is most often ovarian, esophageal, or other gastrointestinal malignancies of the upper digestive tract. Cardiophrenic lymphadenectomy may be performed for diagnostic and/or therapeutic purposes. In the context of ovarian tumors, positivity of these lymph nodes predicts disease extension to the upper abdominal compartment,[2] and resection will be considered to confirm extra-abdominal metastasis[3] and to achieve complete cytoreduction,[4] knowing that the survival benefit has not yet been proven.

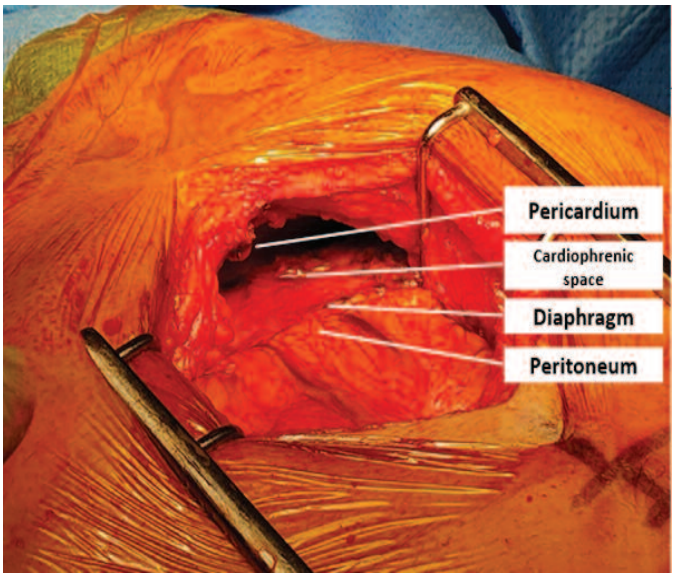

Figure 1. Exposure of the cardiophrenic space.

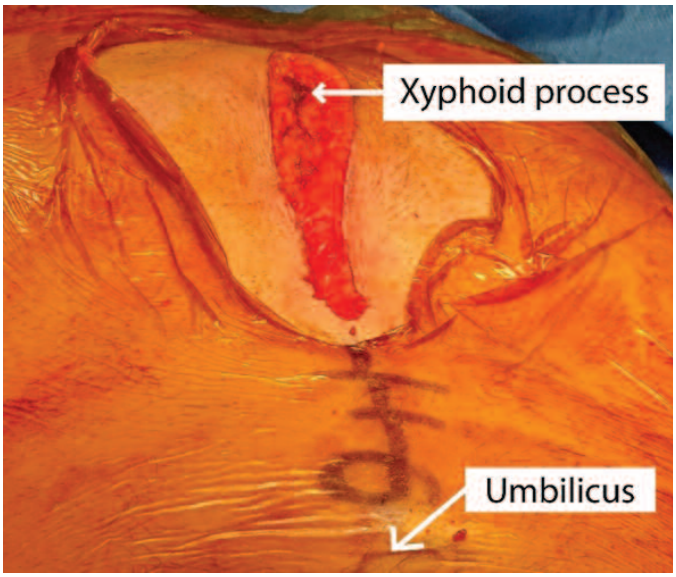

Figure 2. Skin incision for subxiphoid approach.

The extension of liver and biliary tract tumors to the cardiophrenic lymph nodes is rare, given that less than 20% of the lymphatic duct drains into the suprahepatic veins.[5] Nevertheless, its occurrence is relevant for tumor staging, especially in cases where percutaneous biopsy is technically difficult. In such cases, lymphadenectomy via the subxiphoid approach seems a considerable alternative, especially for CPN in the prepericardiac area or in costophrenic adenopathies while avoiding diaphragmatic opening. The transdiaphragmatic approach, which might necessitate hepatic mobilization, is more appropriate for CPN of the middle and posterior mediastinum in the paracaval area or adjacent to the costophrenic angle when diaphragm opening is required.[6,7] The main objective will be to avoid the morbidity associated with pleural or pericardial breach, hence the technique described in this article, which simultaneously ensures good exposure of the surgical site.

SURGICAL TECHNIQUE

The cardiophrenic space (Fig. 1) contains fatty tissue and lymph nodes. It is located at the most inferior part of the mediastinum. The cardiophrenic space is bounded posteriorly by the base of the heart, inferiorly by the diaphragm, anteriorly by the anterior chest wall, and laterally by the two mediastinal pleurae. The cardiophrenic space can be divided into right and left zones in relation to the midline. Laparotomy is the classic approach.

The patient is positioned supine, with right arm alongside the body and left arm abducted at 90°. Surgical draping exposes the anterior chest wall and abdomen to be included in the operative field. The surgeon is positioned on the patient's right and the assistant on the patient's left. The incision is median, supraumbilical, and extends up to the xyphoid (Fig. 2).

After skin incision, the subcutaneous tissue is dissected until the xyphoid process is exposed (Fig. 3). The peritoneum is opened. The diaphragmatic domes and diaphragmatic parietal peritoneum are identified. Both the excision of the xyphoid process and incision of the diaphragm are not mandatory.

An autostatic Beckmann retractor is fixed for lateral exposure and a Farabeuf retractor is placed under the sternum by the assistant (Fig. 4). The domes are deperitonized, starting on either side of the midline. The diaphragmatic peritoneum is lowered. The peritoneum is

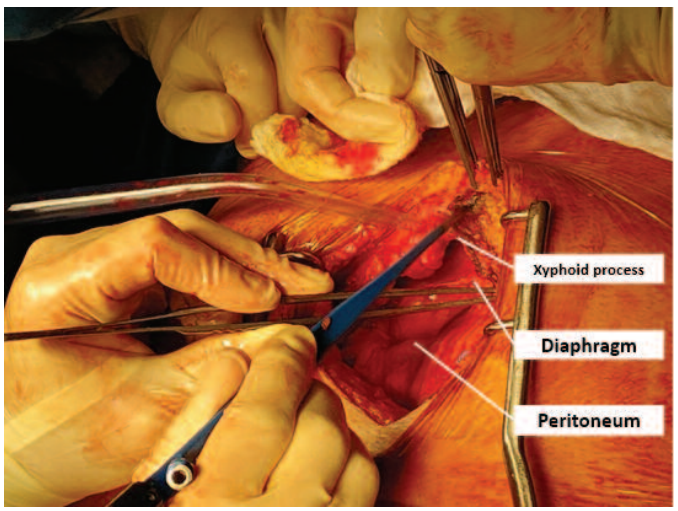

Figure 3. Exposing the xiphoid process.

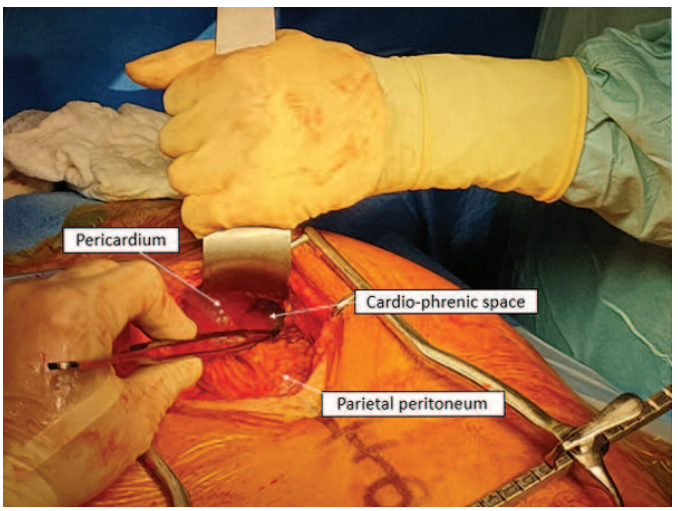

Figure 4. Lowering the diaphragmatic peritoneum.

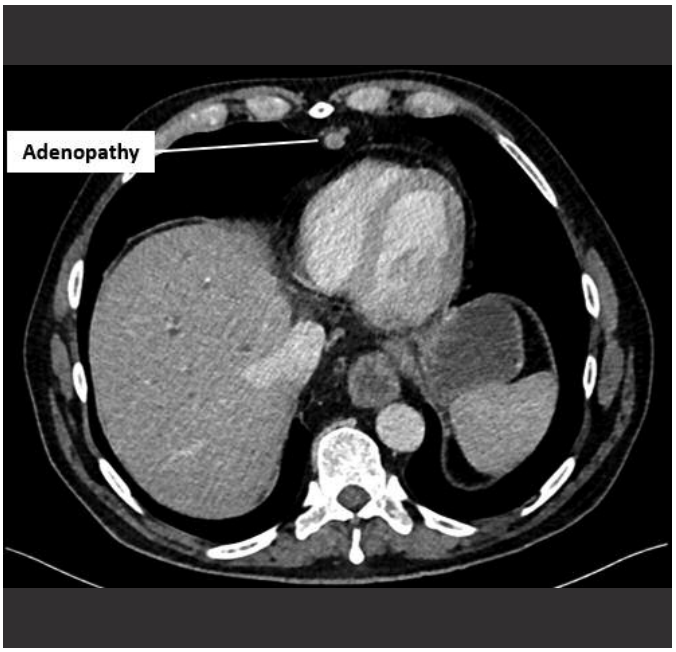

Figure 5. Adenopathy seen on CT scan axial plane with contrast.

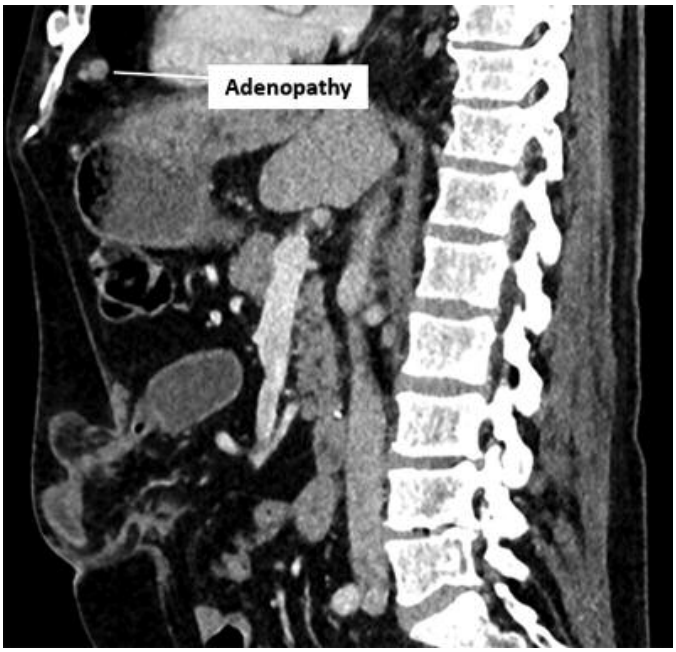

Figure 6. Adenopathy seen on CT scan sagittal plane with contrast.

separated from the muscle fibers of the sternal attachment of the transversus thoracis muscle, which merges with the transversus abdominis muscle. Lymph nodes can be palpated in the fat of the cardiophrenic space. The sternal and costal muscular attachments of the diaphragm are incised (the sternal portion of the dorsal face of the xiphoid appendix of the diaphragm), as well as the transversus thoracis muscle. The cardiophrenic space is exposed by pushing up the pericardial fat.

The sternal portion is detached from the dorsal surface of the xiphoid process. It is formed by two ascending, vertical compartments, stretching parallel from the base of the xiphoid process to the central tendon of diaphragm. These two compartments may be separated by a median, avascular retro-xyphoidal orifice. It is separated on either side from the chondrocostal portion which precedes it laterally by the costoxiphoid hiatus, sternocostal hiatus, or Larrey's cleft. It's a triangular orifice with a posterior apex, the lateral surface of which corresponds to the chondrocostal portion and the medial surface to the sternal portion of the diaphragm. The anterior base of the triangle, in a retroxiphoid position, is lined by the lower compartments of the transversus thoracis muscle, which merges at this level with the transversus abdominis muscle. This hiatus gives way to a number of lymphatic trunks and possibly a fillet of phrenic nerves. The abdominal branch of the internal thoracic artery passes in front of the triangular muscle of the sternum to become the superior epigastric artery at the level of the sixth intercostal space.

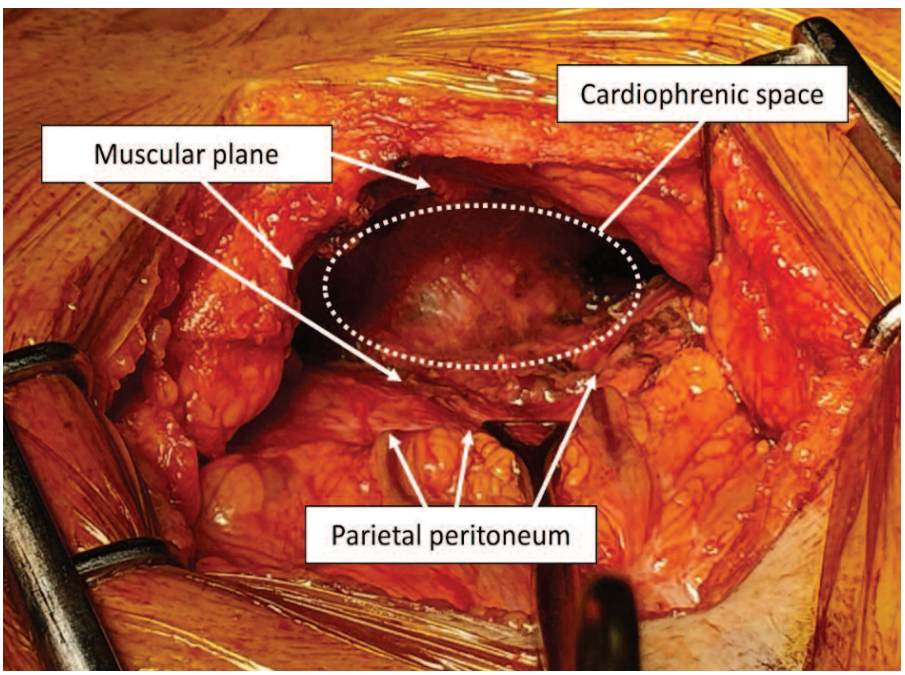

Figure 7. Widened cardiophrenic exposure after bilateral extension of diaphragmatic dissection.

Vertically, the dissection of the cardiophrenic space is continued in the anterior fatty layer to reduce the risk of pleural breach. This meticulous dissection must avoid injury to the phrenic nerve on the left, as well as to the pericardiophrenic vascular pedicle. The next step is cardiophrenic lymphadenectomy, depending on the location of adenopathies on preoperative imaging (Figs. 5 and 6). The lymph nodes are removed along with the surrounding fat. Depending on the location of the cardiophrenic adenopathies, the diaphragmatic dissection can be extended 5 to 7cm laterally to the xyphoid process, following the inferior costal margin. This dissection will allow identification of both pleura and facilitate access to both cardiophrenic angles (Fig. 7).

Figure 8. Skin closure.

After hemostasis with bipolar cautery, the surgeon may choose which surgical site to drain, depending on the risk of pleural or pericardial breach assessed intraoperatively. The diaphragm is reattached using a slowly absorbable suture. Finally, the fascia is closed, followed by skin closure (Fig. 8).

Postoperative follow up is marked by a chest x-ray and hemodynamic monitoring. When in doubt, a follow-up x-ray and/or cardiac ultrasound can be performed to rule out an effusion and/or pneumothorax. STI

AUTHORS' DISCLOSURES

There are no financial conflicts of interest to disclose.

REFERENCES

1. Ragusa M, Vannucci J, Capozzi R, et al. Isolated cardiophrenic angle node metastasis from ovarian primary. report of two cases. J Cardiothorac Surg 2011; 6:1.
2. Luger AK, Steinkohl F, Aigner F, et al. Enlarged cardiophrenic lymph nodes predict disease involvement of the upper abdomen and the outcome of primary surgical debulking in advanced ovarian cancer. Acta Obstet Gynecol Scand 2020;99(8):1092–9.
3. Lopes A, Rangel Costa RL, di Paula R, et al. Cardiophrenic lymph node resection in cytoreduction for primary advanced or recurrent epithelial ovarian carcinoma: a cohort study. Int J Gynecol Cancer Off J Int Gynecol Cancer Soc 2019;29(1):188–94.
4. Boria F, Chiva L. Role of cardiophrenic lymph node removal in advanced ovarian cancer. Int J Gynecol Cancer Off J Int Gynecol Cancer Soc 2021; 31(2):307.
5. Pupulim LF, Vilgrain V, Ronot M, et al. Hepatic lymphatics: anatomy and related diseases. Abdom Imaging 2015;40(6):1997–2011.
6. Martínez-Gómez C, Angeles MA, Leray H, et al. Transdiaphragmatic and transxiphoid cardiophrenic lymph node resection step-by-step in advanced ovarian cancer. Int J Gynecol Cancer Off J Int Gynecol Cancer Soc 2020;30(10):1646–7.
7. Minig L, Arraras M, Zorrero C, et al. A different surgical approach for cardiophrenic lymph node resection in advanced ovarian cancer. Ecancermedicalscience 2017;11:780. Figure 6. Adenopathy seen on CT scan sagittal plane with contrast.