

Case report

Acute pericarditis after transabdominal cardiophrenic lymph node dissection and pericardotomy during ovarian cancer debulking surgery: A case report

Dib Sassine^a, Dimitrios Nasioudis^a, Kathryn Miller^a, Rebecca Chang^a, Derman Basaran^a, Evan S. Smith^a, Sarah Ehmann^a, Dennis S. Chi^{a,b,*}

^a Gynecology Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, NY, USA

^b Department of Obstetrics & Gynecology, Weill Cornell Medical Center, New York, NY, USA

ARTICLE INFO

Keywords:

Ovarian cancer
Complete cytoreduction
Supradiaphragmatic lymph node dissection
Pericarditis

1. Introduction

For patients with advanced ovarian cancer undergoing primary debulking surgery, maximal surgical effort with the goal of achieving complete gross resection (CGR) is crucial and associated with improved survival (Tseng et al., 2018). Pleural, paracardiac and cardiophrenic lymph node metastases are rarely encountered in patients with ovarian cancer (Nasser et al., 2017). However, abnormally enlarged, unresected cardiophrenic lymph nodes due to metastases may worsen survival in patients who have undergone complete intra-abdominal gross resection (Mert et al., 2018). Several case series have demonstrated that intra-thoracic resection of enlarged paracardiac and cardiophrenic lymph nodes is feasible and may prolong the survival of carefully selected patients (Cowan et al., 2017; Garbi et al., 2017). Pleural effusion, chylothorax, pneumothorax, and acute respiratory distress syndrome (ARDS) are the most common pulmonary complications encountered following cardiophrenic lymph node dissection (Nasser et al., 2017; Cowan et al., 2017). However, given the proximity of paracardiac and cardiophrenic lymph nodes to the heart, cardiac complications can sometimes, although rarely, occur. In this case report, we describe an incidental pericardiotomy during resection of an enlarged paracardiac lymph node and suspicious pericardial lesion complicated by postoperative acute pericarditis.

1.1. Case report

A 67-year-old woman with a past medical history of hyperlipidemia controlled with atorvastatin and no other significant cardiac history presented to her primary care physician with complaints of abdominal distention for 2 months. A computed tomography (CT) scan demonstrated bilateral adnexal cystic lesions measuring 2.8 cm on the right and 2.4 cm on the left, as well as extensive peritoneal and omental nodularity. Her preoperative CA-125 level was 800 units/mL, and a CT scan of her chest demonstrated a right anterior supradiaphragmatic lymph node and a mildly enlarged anterior pericardial lymph node (Fig. 1A and B). The patient was deemed a good candidate for primary debulking surgery, and her preoperative work-up was unremarkable, including a normal electrocardiogram (EKG).

The patient underwent an exploratory laparotomy, total abdominal hysterectomy, bilateral salpingo-oophorectomy, bilateral para-aortic lymph node dissection, splenectomy, total omentectomy of greater and lesser omentum, wedge liver resection of segment 7, cholecystectomy with porta hepatis lymphadenectomy, bilateral diaphragmatic peritonectomy, ileocecectomy with ileo-ascending anastomosis, low anterior resection with end-to-end anastomosis, and right mediastinal lymphadenectomy. During supradiaphragmatic lymph node dissection, an enlarged node was found to be adherent to the parietal layer of the pericardium and the decision was made to proceed with excision.

* Corresponding author at: Gynecology Service, Department of Surgery Memorial Sloan Kettering Cancer Center, 1275 York Avenue, New York, NY 10065, USA.
E-mail address: chid@mskcc.org (D.S. Chi).

<https://doi.org/10.1016/j.gore.2020.100683>

Received 20 October 2020; Received in revised form 3 December 2020; Accepted 6 December 2020

Available online 11 December 2020

2352-5789/© 2020 The Authors.

Published by Elsevier Inc.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

However, entry into the pericardial cavity led to pericardial fluid leakage. A representative example of a pericardial defect from a different patient is shown in Fig. 2. Our patient's defect was <0.5 cm in length and was repaired with 3–0 PDS suture placed in an interrupted manner. Postoperatively, a chest tube was placed and started on continuous low-wall suction. When chest tube output was <200 cc per 24 h, suction was discontinued and the chest tube was put on water seal. A chest x-ray checked 6 h later showed no pneumothorax or effusion, and the chest tube was removed on postoperative day (POD) 6. We usually leave a chest tube after large diaphragm peritonectomies and/or resection, since we know from our institutional data and experience that more than half of patients will develop ipsilateral pleural effusion after diaphragm peritonectomy (Sandadi et al., 2014). The operation, which was performed by a gynecologic oncologist, lasted approximately 11 h, and a CGR was achieved.

During recovery in the postanesthesia care unit (PACU), the patient complained of abdominal pain and dizziness, and changes on telemetry

were noted. An EKG demonstrated normal sinus rhythm (NSR) with diffuse ST elevations—EKG changes seen in acute pericarditis (Fig. 3)—and her serial troponin levels were normal. The patient denied any chest pain or palpitations.

She was transferred to a telemetry floor and underwent a cardiology consultation. There was no pericardial friction rub on physical exam. A cardiac echocardiogram was unremarkable, with a left ventricular ejection fraction of 68% and no pericardial effusion. Since the patient was asymptomatic, no intervention was recommended, and the patient was continued on telemetry with the plan to obtain daily EKGs. For any symptoms, nonsteroidal anti-inflammatory drugs (NSAIDs) or colchicine would be started. On POD2, the patient's EKG showed NSR with loss of diffuse ST elevation (Fig. 4). She had no events on telemetry for over 72 h, and telemetry was then discontinued. The remainder of her postoperative course was uncomplicated, and she was discharged on POD8 and is currently receiving platinum-based chemotherapy. On final pathology, the enlarged right supradiaphragmatic lymph nodes were

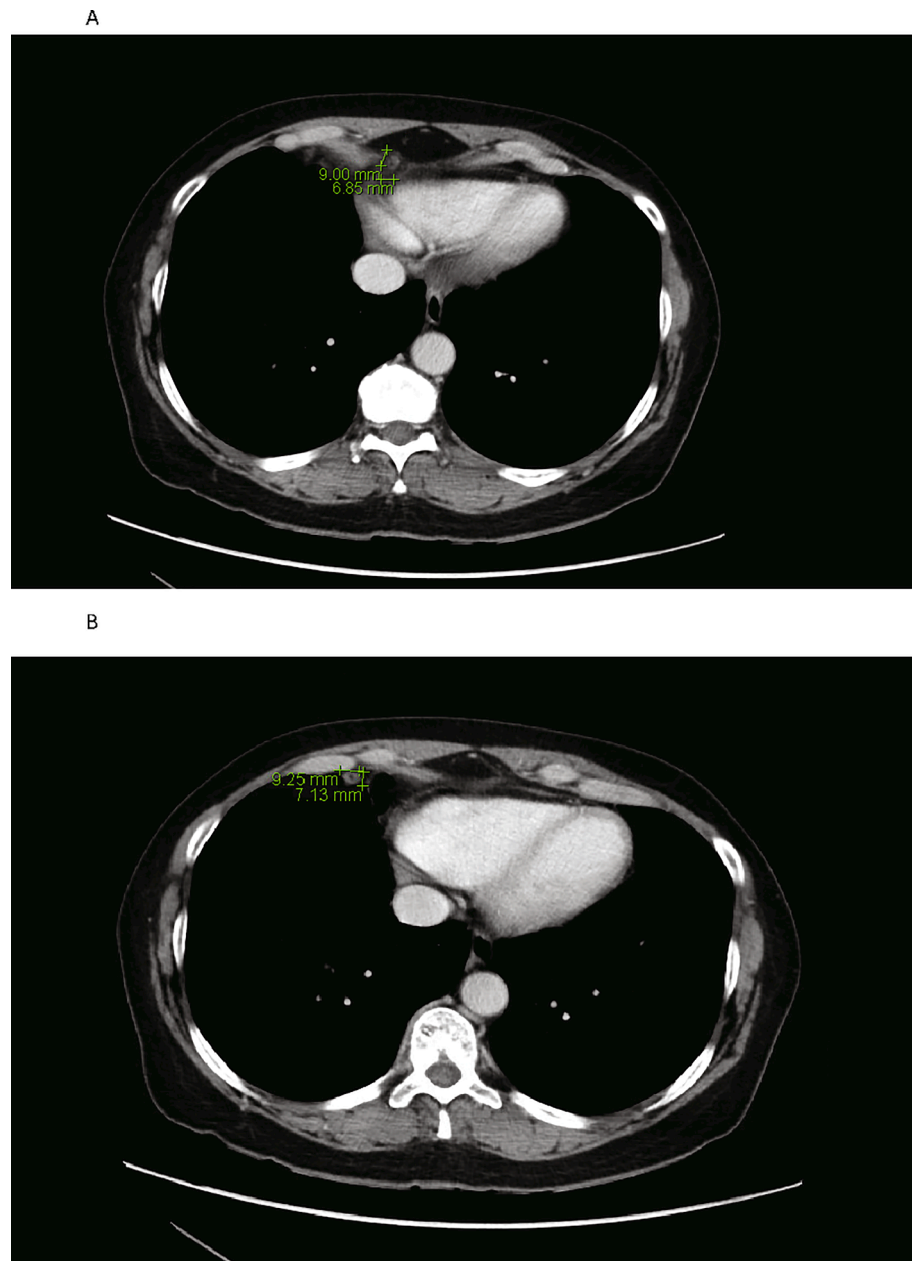


Fig. 1. Preoperative CT scan showing enlarged supradiaphragmatic lymph nodes. (A) A mildly enlarged right anterior pericardial lymph node. (B) A right anterior supradiaphragmatic lymph node.



Fig. 2. Defect in the pericardium created at the time of enlarged cardiophrenic node dissection. Note, the image is a representative example from a different patient than the one in this case report; however, the location and size of the defect are similar. The green arrow points to the pericardial defect. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

positive for high-grade serous carcinoma in 2 of 2 lymph nodes, rendering her disease stage IVB.

2. Discussion

Cardiac postoperative complications following gynecologic surgery are rare, accounting for 1.5% of all complications in a large nationwide sample (Iyer et al., 2015). Cardiac arrhythmias and cardiac ischemia comprise most of these complications. Pericarditis and pericardial effusions, on the other hand, are commonly encountered following cardiothoracic surgery, given entry into the pericardial cavity. As our case demonstrates, rare cardiac complications such as pericarditis can occur when performing intrathoracic cytoreduction in patients with ovarian cancer if the pericardium is entered.

In prior large series describing cardiophrenic lymph node dissection, there were no cases of pericarditis reported. In their initial experience at

a tertiary center, Garbi et al. (Garbi et al., 2017) reported that among 22 patients undergoing transabdominal resection, the most common postoperative complication was pleural effusion requiring chest tube placement in 33%. In a publication of our institutional experience with intrathoracic cytoreduction of enlarged supradiaphragmatic nodes in 54 patients, 4 pulmonary-related postoperative complications were noted (1 pulmonary embolism, 1 chylothorax, 1 pleural effusion, 1 ARDS) (Cowan et al., 2017). In another retrospective study, of 29 patients undergoing cardiophrenic lymph node dissection, entry into the pericardium was noted in 2 cases (1 incidental and 1 due to resection of pericardium and phrenic nerve given contiguous tumor invasion) (Lopes et al., 2019). Similar to our case, pericardial openings occurred during right-side dissection; however, they were kept open per surgeon's decision. No postoperative cardiac complications were reported (Lopes et al., 2019).

Pericarditis can be idiopathic or related to direct or indirect cardiac trauma. It is usually diagnosed by the presence of friction rub; EKG changes, as in our case; and symptoms such as dyspnea and chest pain. EKG changes are classified in four stages. In stage I, ST segment elevations and T waves remain upright; in stage II, ST and PR segments normalize; in stage III, diffuse T-wave inversions remain after ST segments have normalized; and in stage IV, the EKG normalizes. Echocardiography is recommended since acute inflammatory pericarditis can result in pericardial effusions that can impede diastolic function and may sometimes, although rarely, lead to cardiac tamponade, which could require either percutaneous or surgical drainage as a definitive treatment. Patients with pericarditis are usually asymptomatic, and treatment consists of anti-inflammatory agents such as NSAIDs or colchicine, which have been shown to decrease the risk of recurrent episodes of pericarditis, or steroids, which should be used only when NSAIDs are contraindicated or when the pericarditis is part of a systemic inflammatory disease (Lange and Hillis, 2004; Tingle et al., 2007; Alabed et al., 2014).

Post-pericardiotomy syndrome is another complication that can occur in 1.5–15% of patients when the pericardium is opened during cardiac surgery (Lehto et al., 2018; Imazio et al., 2011). It is an immune-mediated inflammatory response that causes fever, pericarditis, leukocytosis, increased erythrocyte sedimentation rate (ESR), and pulmonary infiltrates (Tamarappoo and Klein, 2016). This syndrome can also occur

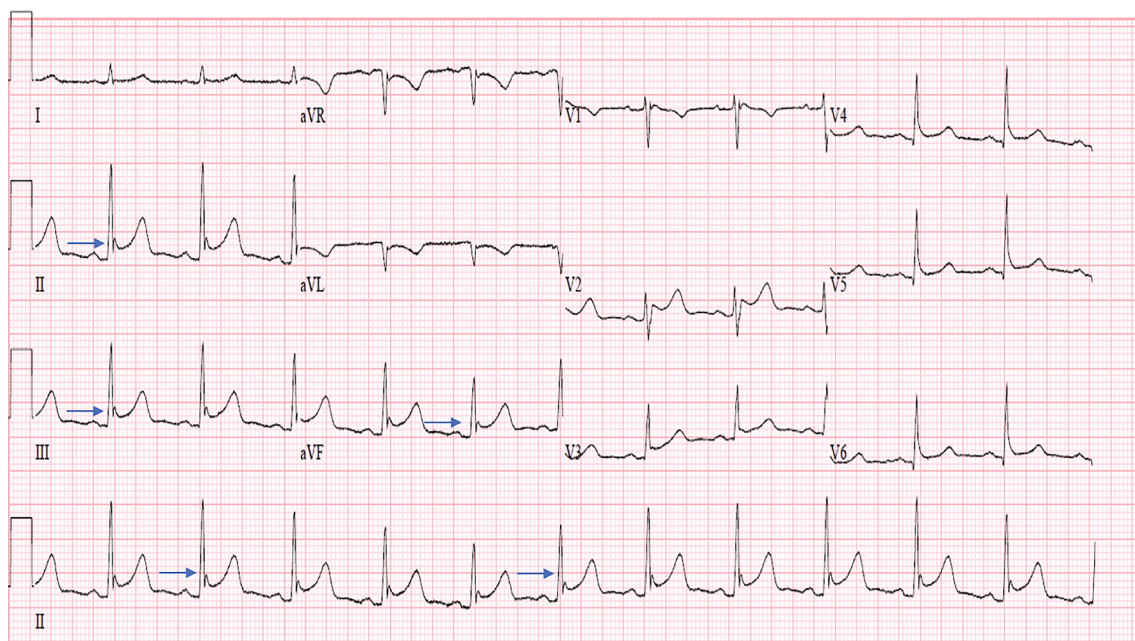


Fig. 3. Postoperative day 1 electrocardiogram (EKG). The EKG shows diffuse ST elevation on postoperative day1 after the pericardium was entered and repaired primarily during transabdominal cardiophrenic lymph node dissection. The arrows indicate ST elevation.

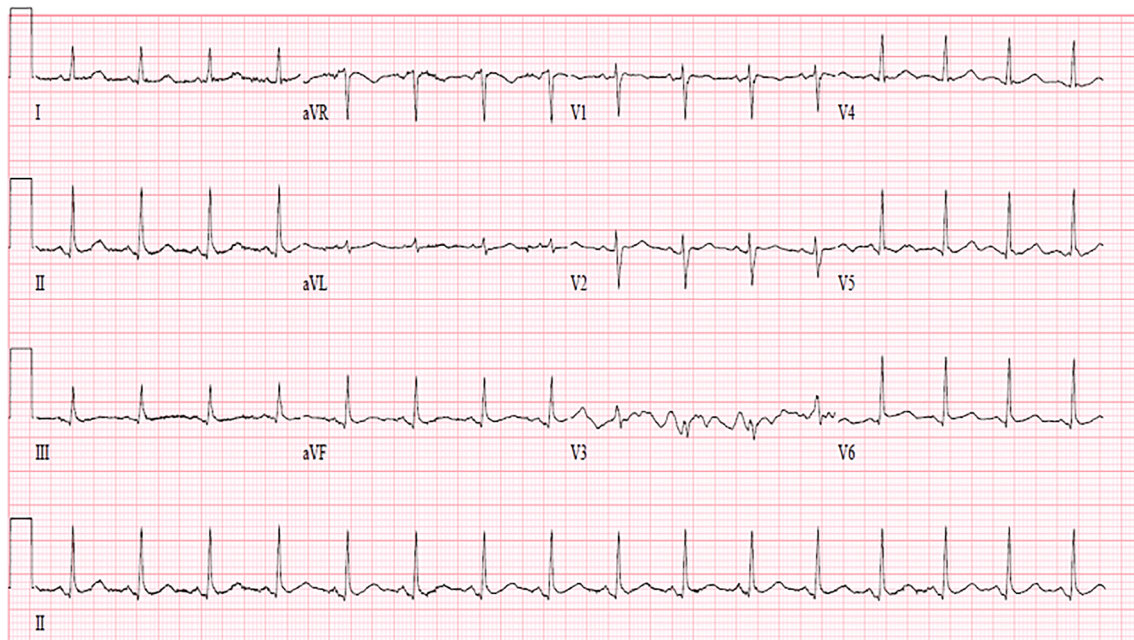


Fig. 4. Postoperative day 2 electrocardiogram (EKG). The EKG shows normal sinus rhythm 2 days after pericardial injury and repair.

after a myocardial infarction, with an incidence rate ranging between 0% and 3% (Shahar et al., 1994; Welin et al., 1983); in this setting, it is called Dressler's syndrome (Dressler, 1959). As with pericarditis, primary management consists of NSAIDs and/or colchicine. Our patient did not show signs of post-pericardiotomy syndrome at her postoperative follow-ups.

3. Conclusion

Pericarditis is an extremely rare complication of transabdominal cardiophrenic lymphadenectomy. It can occur when the pericardium is entered. The diagnosis is made by EKG, which usually shows typical EKG changes as in any pericarditis. Echocardiogram should be ordered to rule out any pericardial effusion. Cardiac consult should be made. Vital signs and white blood cell count should be followed to rule out post-pericardiotomy syndrome. The management of pericarditis in most cases is straightforward and simple—close observation, NSAIDs, and in some instances, colchicine and/or steroids.

Funding

This research was supported in part by the NIH/NCI Memorial Sloan Kettering Cancer Center support grant P30 CA008748.

CRedit authorship contribution statement

Dib Sassine: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing. **Dimitrios Nasioudis:** Data curation, Formal analysis, Writing - review & editing. **Kathryn Miller:** Writing - review & editing. **Rebecca Chang:** Writing - review & editing. **Derman Basaran:** Writing - review & editing. **Evan S. Smith:** Writing - review & editing. **Sarah Ehmann:** Writing - review & editing. **Dennis S. Chi:** Supervision, Writing - review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: [Outside the submitted work, Dr. Chi reports personal fees from Bovie

Medical Co., Verthermia Inc. (now Apyx Medical Corp.), C Surgeries, and Biom 'Up. He also reports previous stock ownership in Intuitive Surgical, Inc. and TransEnterix, Inc.]

References

- Alabed, S., Cabello, J.B., Irving, G.J., Qintar, M., Burls, A., 2014. Colchicine for pericarditis. *Cochrane Database Syst Rev.* (8), Cd010652.
- Cowan, R.A., Tseng, J., Murthy, V., Srivastava, R., Long Roche, K.C., Zivanovic, O., et al., 2017. Feasibility, safety and clinical outcomes of cardiophrenic lymph node resection in advanced ovarian cancer. *Gynecol. Oncol.* 147 (2), 262–266.
- Dressler, W., 1959. The post-myocardial-infarction syndrome: a report on forty-four cases. *AMA Arch. Intern. Med.* 103 (1), 28–42.
- Garbi, A., Zanagnolo, V., Colombo, N., Aletti, G., Achilarré, M.T., Bocciarelli, L., et al., 2017. Feasibility of transabdominal cardiophrenic lymphnode dissection in advanced ovarian cancer: initial experience at a tertiary center. *Int. J. Gynecol. Cancer.* 27 (6), 1268–1273.
- Imazio, M., Brucato, A., Rovere, M.E., Gandino, A., Cemin, R., Ferrua, S., et al., 2011. Contemporary features, risk factors, and prognosis of the post-pericardiotomy syndrome. *Am. J. Cardiol.* 108 (8), 1183–1187.
- Iyer, R., Gentry-Maharaj, A., Nordin, A., Burnell, M., Liston, R., Manchanda, R., et al., 2015. Predictors of complications in gynaecological oncological surgery: a prospective multicentre study (UKGOSOC-UK gynaecological oncology surgical outcomes and complications). *Br. J. Cancer* 112 (3), 475–484.
- Lange, R.A., Hillis, L.D., 2004. Clinical practice. Acute pericarditis. *N. Engl. J. Med.* 351 (21), 2195–2202.
- Lehto, J., Kiviniemi, T., Gunn, J., Airaksinen, J., Rautava, P., Kytö, V., 2018. Occurrence of postpericardiotomy syndrome: association with operation type and postoperative mortality after open-heart operations. *J. Am. Heart Assoc.* 7 (22), e010269.
- Lopes, A., Rangel Costa, R.L., di Paula, R., Anton, C., Calheiros, Y., Sartorelli, V., et al., 2019. Cardiophrenic lymph node resection in cytoreduction for primary advanced or recurrent epithelial ovarian carcinoma: a cohort study. *Int. J. Gynecol. Cancer* 29 (1), 188–194.
- Mert, I., Kumar, A., Sheedy, S.P., Weaver, A.L., McGree, M.E., Kim, B., et al., 2018. Clinical significance of enlarged cardiophrenic lymph nodes in advanced ovarian cancer: implications for survival. *Gynecol. Oncol.* 148 (1), 68–73.
- Nasser, S., Kyrgiou, M., Krell, J., Haidopoulos, D., Bristow, R., Fotopoulou, C., 2017. A review of thoracic and mediastinal cytoreductive techniques in advanced ovarian cancer: extending the boundaries. *Ann. Surg. Oncol.* 24 (12), 3700–3705.
- Sandadi, S., Long, K., Andikyan, V., Vernon, J., Zivanovic, O., Eisenhauer, E.L., et al., 2014. Postoperative outcomes among patients undergoing thoracostomy tube placement at time of diaphragm peritonectomy or resection during primary cytoreductive surgery for ovarian cancer. *Gynecol. Oncol.* 132 (2), 299–302.
- Shahar, A., Hod, H., Barabash, G.M., Kaplinsky, E., Motro, M., 1994. Disappearance of a syndrome: Dressler's syndrome in the era of thrombolysis. *Cardiology* 85 (3–4), 255–258.
- Tamarappoo, B.K., Klein, A.L., 2016. Post-pericardiotomy syndrome. *Curr Cardiol Rep.* 18 (11), 116.

Tingle, L.E., Molina, D., Calvert, C.W., 2007. Acute pericarditis. *Am. Fam. Phys.* 76(10), 1509–1514.

Tseng, J.H., Cowan, R.A., Zhou, Q., Iasonos, A., Byrne, M., Polcino, T., et al., 2018. Continuous improvement in primary Debulking surgery for advanced ovarian

cancer: do increased complete gross resection rates independently lead to increased progression-free and overall survival? *Gynecol. Oncol.* 151 (1), 24–31.

Welin, L., Vedin, A., Wilhelmsson, C., 1983. Characteristics, prevalence, and prognosis of postmyocardial infarction syndrome. *Br. Heart J.* 50 (2), 140–145.