

## CLINICAL VIGNETTE

---

# Persistent Pleural Effusion After Cardiac Surgery

---

Roman Culjat, M.D., and Khalid Eltawil, M.D.

An 81-year-old man presented to the hospital for elective outpatient left inguinal hernia repair. The procedure was cancelled due to dyspnea and a right-sided pleural effusion noted on chest x-ray. His history was notable for Diabetes Mellitus Type 2, Hypertension, and stable End Stage Renal Disease on three times per week hemodialysis. Sixteen weeks prior, he presented to the hospital with dyspnea and pulmonary edema. He was diagnosed with Congestive Heart Failure (Ejection Fraction 30%), Severe Coronary Artery Disease, Severe Aortic Stenosis, and Moderately Severe Mitral Regurgitation. Given his good mental and functional status, it was determined that he would have cardiac surgery. First, he was started on hemodialysis for worsening renal function in order to resolve the pulmonary edema and optimize his pre-operative status prior to cardiac surgery. Fourteen weeks prior, he had Coronary Artery Bypass Grafting, Aortic Valve Replacement, and Mitral Valve Repair. The coronary artery bypass grafting included six vessels: LIMA to LAD and sequential saphenous vein graft to OM1, OM2, OM3, acute marginal off the right, and posterior descending coronary artery off the right. Two days post-op, he had placement of a dual chamber permanent pacemaker for post-operative transient asystole. He had a slow but steady recovery and was transferred to a SNF on post-op day 9. He was readmitted with dyspnea on post-op day 18 and had right-sided thoracentesis on post-op day 18 (2000 cc “bloody fluid”) and post-op day 21 (2450 cc “bloody fluid”) for right-sided pleural effusion. No infiltrates were noted on chest x-ray. No malignant cells were detected, and the effusions were characterized as exudate based on a protein/body fluid to serum ratio of 0.53. An echocardiogram 20 days post-op showed an improved ejection fraction now at 40-45%. He was transferred back to a skilled nursing facility for rehab on post-op day 23. A chest x-ray 27 days post-op showed a small right-sided pleural effusion. The patient was discharged to home on post-op day 31. The patient did well at home. He did not need oxygen but did need to walk with a front wheel walker. Two weeks before presentation (and 12 weeks after cardiac surgery), he did well after elective outpatient right cephalic vein to radial artery fistula surgery.

At the time of presentation for the planned left inguinal hernia repair that was cancelled during dyspnea and right-sided pleural effusion (Figure 1), the patient continued to receive hemodialysis three days per week via a right-sided tunneled dialysis catheter. Social history was significant in that he used to install thermostats and air conditioners and admitted to

years of asbestos exposure. He had a negligible tobacco history and quit tobacco 43 years prior. Physical exam was notable for a body mass index of 22.8, oxygen saturation of 97% on 2 L/min nasal cannula O<sub>2</sub>, a frail appearance, a well-healed sternotomy incision, a left-sided pacemaker, right-sided tunneled dialysis catheter, and reduced breath sounds in the right lung base. He was able to ambulate with a walker. A thoracentesis was done on the right side with removal of 1500 cc of hazy, yellow, and turbid fluid. No malignant cells were detected, and the effusion was considered a transudate with a pleural fluid total protein of 3.2 and a pleural fluid LDH of 170. Due to incomplete drainage, a repeat right-sided thoracentesis was done two days later. Due to slow drainage of fluid, a pleural catheter was placed in the right pleural space for four days and then removed prior to discharge. There was successful removal of pleural fluid but incomplete re-expansion of the right lung. One week and three weeks after the drainage was complete, follow-up chest x-rays revealed persistent unexpanded right lung. Twelve weeks after the drainage was complete, follow-up chest x-ray revealed re-accumulation of fluid in the right pleural space in the area of unexpanded lung. The patient was not symptomatic and did not require oxygen.

There were several considerations for the etiology of the right-sided recurrent pleural effusion and the inability of the right lung to re-expand following the later thoracentesis. The first assessment was to determine a specific cause of the pleural effusion. Congestive heart failure seemed less likely given the improved left ventricular ejection fraction and improved aortic and mitral valve function following surgery. Since the ejection fraction was low normal (40-45%), it may have been a contributing factor. Pleural effusion related to insufficient fluid removal during hemodialysis seemed less likely because he did not have peripheral edema and appeared to be euvolemic. Nevertheless, it may also have been a contributing factor. Malignancy, such as mesothelioma (given the plural plaques and pleural calcifications and history of exposure to asbestos), or bronchogenic carcinoma seemed less likely given the absence of malignant cells on pleural fluid cytology and the absence of pleural effusion prior to cardiac surgery.

At least 40% of patients who undergo coronary artery bypass graft surgery (CABG) develop a pleural effusion in the immediate postoperative period.<sup>1</sup> At approximately four weeks postoperatively over 60% of patients undergoing CABG or CABG and valve surgery had a pleural effusion

compared with 45% of patients undergoing valve surgery only.<sup>1</sup> It was much more common for the patients to have a left-sided effusion with the exception of the patients having valve only surgery where it was more common to have a right side effusion.<sup>1</sup> Although the prevalence of large effusions (4.5%) tended to be less in patients who received SVG (saphenous vein grafts), there was no significant difference in the prevalence of large effusion (>25% of hemithorax) in patients receiving only SVG compared with those who received SVG + IMA (internal mammary artery) grafts.<sup>1</sup> Most of the pleural effusions were exudative.<sup>1</sup> This patient did have an effusion around 3 weeks post-op like the patients described in the 2012 AJRCCM article.<sup>1</sup> Since he was kept in the hospital and SNF for his prolonged recovery, the pleural effusion was noted at an earlier time. Two thousand cc and 2450 cc of “bloody fluid” were drained via thoracentesis on postoperative days 18 and 21, respectively. From postoperative day 21 to postoperative day 27, a small pleural effusion seemed to accumulate in the right pleural space as noted on a chest x-ray done while at a skilled nursing facility a few days before discharge to home on post op day 31. The pleural effusion was not addressed until re-hospitalization 14 weeks after surgery.

Between about 4 weeks after surgery and 14 weeks after surgery, more right-sided pleural effusion had accumulated (Figure 1). It is not known when the fluid stopped accumulating. Trapped lung can be a late sequela of cardiac surgery if a persistent pleural effusion is not treated appropriately while still at the fibrinous inflammatory stage.<sup>2</sup> Trapped lung is one of the few causes of a persistent benign, unilateral pleural effusion.<sup>2</sup> The condition occurs when the lung is covered by fibrous tissue preventing its expansion into the chest wall.<sup>2</sup> This is an uncommon process where fibrinous or granulomatous pleuritis leads to a fibrous membrane covering the visceral pleura while it is separated from the chest wall.<sup>2</sup> The resulting chronic space is fluid filled, and the persistence of the fluid is solely due to hydrostatic equilibrium.<sup>2</sup> The most common causes are inadequately treated parapneumonic effusion, cardiac surgery, chest trauma, and other inflammatory processes involving the pleura.<sup>2</sup> It was felt that the patient had a diagnosis of trapped lung due to recent cardiac surgery. “Entrapped lung,” suggesting an active process needs to be ruled out before making a diagnosis of trapped lung.<sup>2</sup> There was no active process such as cancer, infection, infection, bronchial obstruction, or severe underlying lung disease to suggest an “entrapped lung.” Demonstration of the pleural peel around the right lung was also supportive of the diagnosis of trapped lung. The pleural fluid characteristics were in the transudative range where a total protein 3.2 and LDH 170 were relatively similar (2.9 and 124, respectively) to the pleural fluid in a 2007 Chest article on the *Characteristics of Trapped Lung*.<sup>3</sup>

This patient had 1500 cc drainage of the pleural effusion at 14 weeks, but the drainage was incomplete. A pleural catheter was inserted for four days with further drainage of the pleural space. The right lung did not expand into the chest wall, and there was evidence of a pleural peel on the CXR post thoracentesis (Figure 2). There was subsequent accumulation of pleural fluid into the right pleural space. Although there are data to support successful surgical intervention in these

patients with trapped lung, this patient was much older than the study patients. This patient had multiple co-morbidities that ruled out the possibility of surgery.<sup>4</sup> The patient has done relatively well since the surgery, and he is asymptomatic from the trapped lung.

### Images

**Figure 1.** Chest x-ray at time of presentation, 14 weeks after cardiac surgery. Also noted are calcifications over both right and left diaphragms from history of asbestos exposure.



**Figure 2.** Chest x-ray 3 days after thoracentesis and insertion of right pleural catheter demonstrating lack of expansion of right lung and pleural peel over right lung.



### REFERENCES

1. Light RW, Rogers JT, Moyers JP, Lee YC, Rodriguez RM, Alford WC Jr, Ball SK, Burrus GR, Coltharp WH, Glassford DM Jr, Hoff SJ, Lea JW 4th, Nesbitt JC, Petracek MR, Starkey TD, Stoney WS, Tedder M. Prevalence and clinical course of pleural effusions at 30 days after coronary artery and cardiac surgery. *Am J Respir Crit Care Med.* 2002 Dec 15;166(12 Pt 1):1567-71. Epub 2002 Oct 11. PubMed PMID: 12406850.

2. **Doelken P, Sahn SA.** Trapped lung. *Semin Respir Crit Care Med.* 2001 Dec;22(6):631-6. PubMed PMID: 16088707.
3. **Huggins JT, Sahn SA, Heidecker J, Ravenel JG, Doelken P.** Characteristics of trapped lung: pleural fluid analysis, manometry, and air-contrast chest CT. *Chest.* 2007 Jan;131(1):206-13. PubMed PMID: 17218577.
4. **Celik S, Celik M, Aydemir B, Tunckaya C, Okay T, Dogusoy I.** Long-term results of lung decortication in patients with trapped lung secondary to coronary artery bypass grafting. *Ann Thorac Cardiovasc Surg.* 2012;18(2):109-14. Epub 2011 Sep 29. PubMed PMID: 21959199.

*Submitted August 14, 2015*