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## **Thoracic and Cardiovascular Surgery Sample Case**

### **Lung cancer with pneumonectomy (lung removal surgery), post-operative hemorrhage, re-operative, pneumonia in remaining lung and death.**

According to the records, the patient coughed up blood and had a chest x-ray that showed a tumor mass and a CAT scan confirming this 3 x 4 centimeter irregular lesion that was consistent with lung cancer. This was in the right upper lobe. On the right side of the chest, the lung has three lobes, or segments, each supplied by a separate artery system and bronchial tube division.

He had pulmonary function studies that revealed adequate lung function for the operation, which would hopefully be curative. According to the records, the risks and complications of the procedure were reviewed with the patient by the surgeon, Dr. #1, and the patient consented to the operation.

The patient had a history of cigarette smoking but had stopped for about 5-6 years. However, there would be lung damage that, to some degree, was irreversible. Because of the cancer, operative intervention was the treatment of choice considering the absence of obvious metastatic cancer to any other part of the body.

Surgery took place on August 31. Dr. #1 describes the operation as being performed in the usual and standard manner, and the Operative Report was dictated by him on the same day of surgery, which would assure some accuracy. He initially hoped to remove the right upper lobe, or possibly the right upper and right middle lobes, and spare the right lower lobe. A sampling of the lymph nodes (the site to which lung cancer frequently spreads) was initially negative.

At the start of the operation, he had removed the right upper lobe. He said, "the anterior arterial branch was divided between heavy silk ties and 4-0 Prolene (nylon) ligatures and the upper lobe pulmonary vein was likewise divided." This lobe was separated from the

right middle lobe, and it appears that he removed the right middle lobe to gain further access to the remaining pulmonary arteries.

At this point in the operation, a lymph node that was just on top of the pulmonary artery going to the upper lobe segment was sent to the pathologist for a frozen section (instant examination by microscopic evaluation) and was returned as positive for cancer. He then said, "at this point, because of the lymph node being fairly close to the line of resection (the site of the surgical excision), and having negative lymph nodes elsewhere in the mediastinum (central portion of the chest) we decided to perform a pneumonectomy (removal of the entire right lung) to get a cleaner margin (to have a higher cure rate)." The remainder of the operation clearly describes removal of the rest of the lung, with tying off of the branches of the pulmonary artery and vein and the bronchial tube. The chest was then sutured closed and the patient taken to the recovery room.

Unfortunately, after the endotracheal tube was removed (extubated), the patient developed shock (low blood pressure and rapid heart rate). The drop in blood pressure responded to rapid intravenous fluid administration, and when the chest x-ray revealed haziness in the right chest consistent with bleeding, the patient was taken back to the operating room. An endotracheal tube was re-inserted, and the chest was opened. The rest of this Operative Report of August 31, for this procedure, which was also dictated on August 31, is a little bit confusing and contradictory.

He first says, "finger control was done of the hilum (the central portion where the lung is attached to the blood vessels) and it was evident that a tie had come off the anterior branch of the upper lobe." He then sutured this over. A few sentences down, he says, "all the other suture lines had already had running layers of Prolene and this particular anterior branch had been treated with heavy tie and 4-0 Prolene stick tie. It was not apparent why this site was bleeding. Both a tie and a stick tie (a suture ligature) appeared to be in place." Thus, in one part of the report he said it had come off, and in the other part of the report he says it was in place. In any event, the patient was bleeding from that chest site and required immediate attention which was given by Dr. #1.

Postoperative bleeding from a ligature coming loose in a pulsating area adjacent to the heart is an unfortunate mal-occurrence, in my opinion. I do not believe it would be from a departure from the accepted standards of care that could be supported by an independent expert.

The patient was timely treated with appropriate fluid, including blood; the shock was corrected rapidly; and thereafter the patient appeared to be stable.

The chest x-ray report of August 31, said, "the left lung appears to be clear and well-aerated." This is postoperatively. Two hours later, some congestion was noted. However, on September 1, the report showed "the left lung remains clear. . ." Later that day, there was some increased congestive-like changes within the lung. This remained unchanged on September 2, and unchanged on September 3. However, on September 4, there were more changes within the left lung that could be consistent with excessive fluid.

On September 5, they said, "stable left pneumonia." Later on September 5, they said it was stable but there was "extensive left lung pneumonia."

By September 6, there was some slight improvement. This was basically unchanged on September 7, but got worse on September 8. It was unchanged on September 9, but more extensive by September 10. The next chest x-ray report was on September 11, and there was no significant change.

The Physicians progress notes are quite detailed. After the pneumonectomy, the patient bled; was taken back to the operating room; the artery was oversewn; and the patient received four units of packed red blood cells. He was stable on September 1 and September 2, however he started complaining of shortness of breath. The patient received oxygen supplementation, including a re-breather mask with 100% oxygen supplementation. A pulmonary specialist, Dr. #2, was called in attendance and noted that the patient might get worse before getting better, and recommended the insertion of an endotracheal tube which was placed by the Anesthesiologist on call. All this meets the standard of care. At that time, the patient's oxygen saturation had improved somewhat while on the ventilator. This was properly managed throughout his course of care by Dr. #2. The patient also received additional blood to increase the oxygen-carrying capacity.

Throughout his care, he was seen by the respiratory therapy department for chest physical therapy, for nebulization therapy to loosen the mucus within the lungs, and for suctioning. Their notes are quite extensive, and their care appears to be proper.

Unfortunately, when patients are placed on a ventilator, they cannot effectively cough. To cough, you have to close your vocal cords and build pressure up within the chest cavity, and then open the vocal cords suddenly for a rapid exhalation which brings up mucus. When the endotracheal tube is in place, the vocal cords are maintained in an open position and the airway through the endotracheal tube is always open. Thus, a patient cannot usually effectively cough. Frequent suctioning is required, and this was done frequently by the nurses and the respiratory therapists.

Though the use of the ventilator increases oxygenation within the lungs, as I mentioned, it does impair the ability to cough and, thus, it is a double-edged sword. It does increase the risk of pneumonia, while keeping the patient alive.

During the course of care, an infectious disease consultant was called in attendance on September 5, and followed the patient throughout the hospital stay. Appropriate recommendations were made for antibiotic therapy.

By September 7, the pulmonologist noted that the pulmonary status was worsening. Because of a concern for infection within the left chest cavity, a thoracentesis (needle sampling of the fluid) was performed. Initially, the culture was negative. However, eventually, the culture showed some germs (Streptococcus), as did the mucus within the lungs during the bronchoscopy procedure (passage of a lighted telescopic tube down into the lungs for examination and removal of fluid for analysis). They also ruled out the possibility of tuberculosis and monitored the antibiotic levels within the blood.

Despite the flexible bronchoscopy procedure performed on September 10, and the use of the ventilator, the patient's condition continued to deteriorate. By September 10, they noted the prognosis was very grim, and this was clearly discussed with the wife and brother. Despite manipulations with the ventilator by Dr. #2, which were appropriate, his condition worsened and the patient died at 2:55 a.m. on September 12.

The pathology report on the lung surgery specimens revealed the presence of the 3 x 4 centimeter (1 inch = 2.54 centimeters) lung cancer and the positive lymph node that was removed during the surgery noted above.

An autopsy was performed, and the only significant findings involved the left lung which showed "organizing pneumonia/lobar consolidation."

Throughout the course of care, there was concern about the amount of fluid the patient was receiving and the amount he was urinating. Appropriate diuretics were used to try to keep the blood volume and body fluid volume in a stable situation. The patient was prone to fluid retention with a delicate balance required not to remove too much fluid because of the propensity to go into shock (labile blood pressure). The records show that appropriate diuretics were used and fluid given to the patient to maintain a normal state as possible. The marked congestion within the lung at autopsy was consistent with the severe pneumonia that developed despite proper respiratory therapy, pulmonary intervention, and antibiotic therapy.

Because of the long past history of smoking, both lungs were not normal. Chronic changes occur to the bronchial tube linings that impair the ability of the lung to clear

mucus and secretions, even when the patient is not on the ventilator. The use of the ventilator was required in order to maintain adequate oxygenation of the remaining lung. I want to point out that the left lung is approximately 40% of the total lung volume, because the heart sits mostly on the left side of the chest. The entire right lung had to be removed, and it was a reasonable judgement call by Dr. #1 to remove the right lung at surgery to increase the cure rate.

Based upon my review of all the records, it appears the patient required the operation, had an unfortunate complication of hemorrhage that was immediately noted and corrected, and the patient was stable and improving for two days postoperatively, at which time he developed increasing shortness of breath. He required intubation and the use of a ventilator to maintain oxygenation, and he had appropriate consultations by a pulmonologist and infectious disease consultant with proper medical care given. Unfortunately, the patient developed a progressive congestion within the lung, overwhelming pneumonia, that resulted in the inability to adequately receive oxygen despite proper attention, and that caused the death of the patient.

Based upon my review of all these records, I do not find departures from the accepted standards of care. Different facts would make a significant difference in the opinion.