Introduction

Empyema has many causes, but it is mainly caused by pneumonia. It is often found in areas where treatment for pneumonia is not available or at times when treatments for pneumonia are not effective. It can be life-threatening when not treated, especially in children; "Bacterial pneumonia can be severe and life-threatening, accounting for ~3 million pediatric deaths per year worldwide, primarily in resource-poor countries." (1). The treatments for empyemas are similar in adults and children. There is much research surrounding the treatment of empyemas in children, but this a paper that takes a look at the treatment of an empyema in an adult, male patient.

Patient Profile

This patient is a 56 year old male who was in the acute rehabilitation unit (ARU) from 1/20/2012 to 2/8/2012 and then transferred to the intensive care unit (ICU) after he had surgery to resolve his empyema. He was admitted to ICU on 2/8/2012 and was discharged from the surgical floor on 2/21/2012. This patient's medical past is complex. In December of 2011, this patient had a subtotal colectomy due to colon cancer. He had an ileostomy placed that failed and was revised, but developed complications due to pseudomembranous colitis (C.diff). This led to septic shock and aspiration pneumonia and finally chronic respiratory failure where the patient received mechanical ventilation and had a tracheostomy placed. After these unfortunate events, the patient was weaned off the ventilator and tracheostomy in Select LTAC and transferred to ARU where he was recovering, when the medical team noticed a pleural effusion that was found to be a loculated empyema. The patient then underwent a thoracotomy for decortication of his left lung. Chest tubes for drainage were placed and patient was admitted to ICU. After his surgery, this patient developed a small bowel obstruction (SBO) and was started on total

parenteral nutrition (TPN) by MD order. This patient was discharged to Select LTAC because of his chest tubes. In addition, this patient had a PEG tube from another hospital, which he was not using upon ICU admission, just flushing to keep the integrity. When he was admitted in to ARU from Select LTAC, it was noted by the MD that the patient's appetite was poor, was feeling weak with eating, had poor endurance, and was "severely malnourished." This patient also has a history of poorly controlled diabetes.

This patient is not married, although he refers to his long time significant other as his wife; they live together. This patient states he was a truck driver and often drove very long distances, making proper nutrition for him difficult. The patient was not particularly physically active. This patient does cook and shop at home with his girlfriend. Based on this patient's history, it is unclear of his alcohol and tobacco use. There are times when he denied the use of both, but there are records claiming he has used both.

When the RD assessed this patient in the ICU, it was noted that the patient had had significant weight loss: >80 pounds lost since October 2011 per pt, making him 69% of his usual body weight in the ICU on 2/8/2012. The patient reported that his appetite was poor during this weight loss period due to an infection of C.diff colitis because of a complicated ileostomy placement. It was noted in his records that the ileostomy was placed in December 2011, so it is unclear exactly when he started losing weight. The patient had an ileostomy bag in the ICU and did not mention that he was having any problems with it. The RD continued to follow this patient and provide nutritional care after he transferred out of ICU.

Disease Background

This is a patient with a complex medical history. The main reason for this patient's admission in to the hospital from ARU was for an empyema; he became more complex during this stay. For this paper, I will focus on covering his diagnosis of an empyema.

An empyema is the accumulation of pus in any body cavity, although the most common is called a thoracic empyema. In a thoracic empyema, the pus is accumulated in between the parietal and visceral pleura. It is a specific type of pleural effusion, in that it is the accumulation of pus; whereas, in general, a pleural effusion can be accumulation of any fluid, such as blood or chyle. The accumulation of pus is not only called an empyema, but also a pyothorax.

There are many causes of empyema. Some of them include chest trauma, thoracic surgery, chronic drainage of a malignant effusion, the spreading of sepsis, and respiratory infections, including pneumonia and tuberculosis. The most common cause is pneumonia. Regardless of the cause, empyemas involve a bacterial infection (2). Empyemas develop from pleural effusions, which can be classified as a transudate or exudate effusions. Transudate effusions develop from a systemic influence that alters the pleural fluid, such as CHF or renal failure. Exudate effusions develop from local factors, like pneumonia or pulmonary embolism (3).

An empyema develops in three stages. When referring to a parapneumonic empyema, the first phase is called the exudative or serous phase. The pus in the pleural cavity is still sterile, the pH of the fluid is >7.2, and the glucose level of the fluid is >40 ml/dL. The second phase is called the fibropurulent phase. The pus will become thicker and more opaque with positive bacterial cultures, meaning it has become infected. The pH and glucose will drop and loculations will begin to form because "fibrin is deposited on the pleural surface," (3). Stage three is called the organization phase, because "fibroblasts infiltrate the thickened pleural surface forming the

'pleural peel,'" which can entrap the lung (3). This thickening is known as cortication, which is the stage my patient was in. In stage two, drainage is indicated and in stage three, it is necessary (3).

According to Escott-Stump in Nutrition and Diagnosis-Related Care, a dietitian's intervention with a thoracic empyema is level 2 acuity (out of 4 levels) (4). My patient had the most severe level of empyema and required careful nutrition intervention. The main nutrition interventions are correcting weight loss, reducing anorexia, and providing wound healing (4). Another nutritional intervention is determining and managing the appropriate diet for the patient. In a nursing magazine, the clinical management of empyemas is discussed by a nurse who concluded: "respiratory assessment, nutritional support, pain management—these are essential nursing responsibilities in caring for the empyemic patient," (5). The nutrition aspect is important because "pulmonary structure and function are also adversely affected by chronic malnutrition…One of the most striking effects of malnutrition on the respiratory system is that it reduces the capacity of patients to sustain adequate levels of ventilation," (6). The nurse noted that the patient she had been taking care of was nutritionally compromised by "the effects of fever and chronic infection—specifically acceleration cellular metabolism and anorexia" (5). It is of vital importance to keep these factors in mind when nutritionally intervening for a patient with an empyema. It is also important to know their history because illnesses of their past may affect their nutrition treatment in the future. An RD needs to pay close attention to the signs of malnutrition in the patient. Albumin and prealbumin are one way to do this, as well as looking at the patient's changes in weight. According to, Huang et al., "A significant weight loss is the major sign of malnutrition. Recent loss of more than 10% of the usual body weight indicates severe malnutrition. It has been reported that 35% of patients have lost >10% of original body

weight during hospitalization" (7) Ways to fix malnutrition and decrease anorexia are to send smaller, more frequent meals, send nutritional supplements, recommend an appetite stimulant, provide diet education, or recommend and manage enteral or parenteral nutrition. It is also of note that an open thoracotomy for a full lung decortication is an invasive surgery and will require more calories and protein to promote healing.

In addition to thinking about those nutritional concerns in a patient with empyema, an RD must also consider the appropriate nutrients for their patient. An intake high in vitamin C, antioxidants, and omega-3 are known to have a protective effect against developing lung problems. Nelms et al. says, "There is increased evidence correlating the role of dietary antioxidants such as vitamin C, vitamin E, β-carotene, and selenium with healthy lung functions. A variety of antioxidants are present in the extra cellular fluid and appear to play an important role in protecting the lungs from oxidant injury as the result of the inflammatory process caused by inhalation of cigarette smoke and other pollutants," (8). The most common way to develop an empyema is by pneumonia, so making sure the patient is being nutritionally provided for with these nutrients in this stage can avoid an empyema.

Symptoms of an empyema are chest pain, dry cough, fever, malaise, shortness of breath, and unintentional weight loss. Using a stethoscope, the doctor can note muffled breathing and when tapping the chest, a dull sound. If this condition is not treated quickly and efficiently, the patient can fall into a coma or die. The pleural space can rupture or the infection can spread to the heart of brain (4).

Treatments available for empyema vary depending on the severity and stage of the condition. Doctors have the choice of drainage, fibrinolytics, antibiotics, and surgery. However, according to the American Thoracic Society, "The use of intrapleural fibrinolytic agents remains

controversial. A recent Cochrane Database review suggests that there may be some benefit, but high quality clinical studies are lacking" (9). The least invasive form for resolving an empyema is using antibiotics, but most often, a thoracentesis is done in addition, which can be used for drainage as well as diagnostic purposes. If the empyema is in stage one, usually thoracentesis with antibiotics will be sufficient. If the thoracentesis shows that the empyema has advanced to stage two, this patient will most likely need antibiotics plus chest tube drainage or possibly surgery. If the patient's empyema does not resolve after this or they notice loculations are present, this patient is said to be in stage three, which is the most severe stage of an empyema. At this point, the use of fibrinolytics or surgery is considered depending on if there is a pleural peel present (10). Fibrinolytics are agents that break up blood clots. The main components of a blood clot are platelets, thrombin, and fibrin (11). In empyemas, there are high levels of neutrophils and fibrin, among other material (1) Empyemas evolve from "free-flowing exudates to fibrin loculation and eventually to collagen formation; the formation of fibrin impairs drainage and promotes loculation," (12). The most common fibrinolytics used are streptokinase and urokinase, but TPA has been used as well (13). If there is frank pus present, most often they will need to do surgery. The least invasive type of surgery to relieve the empyema is called the VATS procedure, which stands for video assisted thoracic surgery. This procedure is also known as thoracoscopy and can be used in combination with fibrinolytics. In describing the VATS procedure, Landreneau et al, says, "VATS appears to be an effective initial management for most complex pleural empyemas…excellent visualization of the pleural cavity permits drainage of loculated fluid, removal of fibrinous material, and the ability to perform limited decortication of the lung. Early referral for this minimally invasive surgical intervention can assist in controlling the fibrinopurulent phase of empyema before it progresses to the chronic fibrotic phase," (14).

However, if VATS is not enough or fails, the surgical team must be ready to convert to thoracotomy and perform an open decortication. Decortication is the removal of the pus and pleural peel on the outside of the lung in the pleural space. My patient had an open thoracotomy with full decortication due to a failed VATS procedure.

In the beginning stages of an empyema, the prognosis is usually good. As the severity of an empyema increases and the need for more invasive procedures are necessary, the prognosis looks poorer. A thoracotomy is an invasive surgery and the more medical complications a patient has, the higher the risk is for death or having complications after the surgery.

It is of note that patients who have an empyema and are treated at facilities with the equipment and expertise to fix it usually have a good outcome. However, those in countries with poor resources generally have a poor outcome, especially since pneumonia is the main cause of an empyema; they have a lack of medicine/treatments as well as the proper nutrition. In a study by DeLuca et al., that studied the epidemiology of empyemas, they found that "in hospitalized children ages 1 to 23 months in Ibadan, poor nutrition was found to be a factor leading to empyema secondary to lower respiratory tract disease associated with respiratory syncytial virus infection" (1). This finding is true for other countries of similar economic position.

My patient's initial diagnosis was for an empyema, which the doctors discovered was stage three and required surgery. They attempted the VATS procedure, but failed, and resorted to an open thoracotomy for decortication. This patient became more medically complex during his stay, as he developed a post operative SBO. The patient received TPN for 4 days while remaining NPO/CL or on a diet. The patient was aware of why his surgery was done and that he had chest tubes. He knew the chest tubes would prevent him from returning to the acute rehab unit at the hospital and was told he would be discharged to Select LTAC. However, based on my

conversations with the patient, I do not think he was aware of why he was receiving TPN. The patient also did not understand how to manage other factors of his health, including his diabetes.

Current Admission

This patient's diagnosis was an empyema. During the VATS procedure, they discovered that that procedure would not be sufficient enough for success due to multiple loculations, so they resorted to a full thoracotomy for a left lung decortication. After the surgery, he had two chest tubes placed for drainage. Due to this patient's subtotal colectomy for colon cancer, he had an ileostomy procedure performed with a bag placed. However, as noted in his past medical history, there were complications with this. During this patient's stay, he developed a small bowel obstruction, for which the MD placed the patient on TPN with various diet progressions which will be discussed in the Nutrition Care Process.

My patient was on some medications with nutrition interactions. The first was insulin due to his diabetes (humalog and lantus). Pantoprazole was also a routine medication, which a proton pump inhibitor. A side effect of this is diarrhea. They also gave him bisacodyl for constipation and reglan every eight hours to promote gastric emptying. Side effects of this are nausea, diarrhea, restlessness, drowsiness, fatigue, and dizziness. This patient was on metronidazole (Flagyl) for eight days, which is a antibiotic. Side effects of this are anorexia, metallic taste, epigastric distress, diarrhea, dizziness, and headache. In addition, vancomycin was given for six days by IV before they switched to flagyl orally. Side effects of IV vancomycin are having an allergic reaction/rash, lower white blood cells, and "red man syndrome," which is development of pruritus, hypotension, dizziness, agitation, and overall feeling of discomfort. My patient did not have this reaction because it develops within the first few hours of receiving the first dose.

Nutrition Care Process

This patient had a complicated diet order. After his surgery, he was advancing from NPO to a diabetic diet; however, about this time, he complained of nausea and had vomited. They discovered he had a small bowel obstruction vs. an ileus, so the surgery doctor decided to make him NPO and place a central line for TPN. However, that same day, another doctor advanced him to a clear liquid diet. The next day, the surgery doctor put him back on NPO and had a pharmacy consult for TPN. The next day, the other doctor advanced him to a full liquid diet and the patient was started on TPN. The next day, the surgery doctor ordered a clear liquid diet. The TPN was still hung and pharmacy consulted again for the next day. It was this time that the RD re-assessed this patient and advised that this patient's diet be advanced as tolerated to a 2200 cal DM, GI soft diet as tolerated and that they would send supplements as diet allowed. The next day, the doctor (not the surgery doctor) took the RD's recommendations and ordered the soft select diet, 2200 DM. The TPN was still hung and it was noted that this patient's blood glucose levels were high. The next day, an 1800 ADA diet was ordered by the surgery doctor and added a cardiac restriction the next day. However, the TPN was still hung again due to a pharmacy consult by the surgery doctor. It was at this time the RD recommended to discontinue the TPN because the patient was tolerating at least 75% PO consistently, which the doctor agreed to the next day.

This patient was 5'11'' and weighed 88 kg upon admission to ICU after surgery; this put him at 113% of his IBW. Even though he was slightly overweight, he still had significant weight loss due to his history of C. diff colitis. The patient at the time of assessment was 69% of his UBW and per patient, had been losing weight since October 2011, although his records state his ileostomy was placed in December 2011. Due to this weight loss, this patient was placed at severe compromise.

My patient did not have many unusual lab values. His albumin was consistently low, which can be a sign of malnutrition. His glucose was high most of the time. He also had a lab test for C.diff, which was found to be negative. His sodium was also consistently low, which could be due to sodium losses with his ileostomy. All of his other electrolytes were stable and are not shown here for that reason.

Lab	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21
Glucose	278	182	133	101	129	93	164	164	127	158	126	114	160
BUN	13	17	11	8	5	6	9	9	9	8	8	9	9
Sodium	128	131	133	129	135	134	136	136	135	132	133	132	133
Albumin					2.1		1.8	1.9	2.1				

This patient does not follow a specific diet at home even though he has diabetes. The patient said he had never had any formal education on this diet and had never tried to follow this diet. He requested information from the RD, which was provided to him. It was also discovered that this patient chose high fat meats, like chicken wings, steak, beef hotdogs, bacon, and sausage, so the RD discussed foods that were more appropriate for this patient. Due to the abdominal pain this patient had been having, he was very concerned and anxious about his diet. He wanted to make sure he chose the correct foods off the menu, so the RD oriented him to the GI soft foods available. At the end of the educations, the RD felt that this patient was going to try and change his lifestyle for the better.

This patient had been evaluated by an RD in ARU. The MD had ordered a calorie count on this patient due to suspected poor nutrition. At the end of the calorie count, it was found that this patient met only half of his calorie needs and 100% of his protein needs. He was receiving supplements (SF might shake and propass mousse TID). Per RD note, this patient was picky and

sometimes his tray was incorrect. When this patient was admitted to ICU after surgery, the patient said that his appetite was poor and that he had been eating better in ARU. In ARU, it was not documented that this patient had any education about a diabetic diet. After this patient's surgery and his transfer out of ICU, he was having poor intake for several days (<50%). It was especially poor when the patient had his small bowel obstruction. After it resolved in a couple of days, his PO intake increased to 75-100%. In ICU this patient was a severe compromise and remained severe until his small bowel obstruction resolved. Then he became moderate, and eventually mild. In ICU, this patient's needs were calculated as follows: 27-32 kcal/kg, *actual BW, for a total of 2200-2550 kcal; 1.2-1.4 g/kg, *actual BW, for a total of 96-112 g protein. When this patient transferred out of ICU his needs were calculated as follows: 25-30 kcal/kg, *adjBW, for a total of 2025-2430 kcal; 1.0-1.3 g/kg, *adjBW, for a total of 81-105 g protein; at least 1 ml/kcal for fluid.

Also to consider in calculating this patient's needs is the fact that he had a subtotal colectomy, with an ileostomy bag placed. Having an ileostomy causes decreased absorption of fat, bile acid, vitamin B12 absorption, and has greater loss of sodium and potassium. Fluid and electrolyte balance, as well as eating foods that do not promote blockage are important. As an RD, he or she needs to make sure the patient receives adequate protein and calories, vitamin B12, folacin, calcium, magnesium, iron, sodium, vitamin C, potassium, and fluid (15). To do this, monitor their PO intake and provide nutrition education that covers the food sources of these vital nutrients. It would also be ideal to mention foods that may cause discomfort, such as gas-forming foods like legumes or broccoli. Probiotics and prebiotics may also be beneficial, especially right after the surgery for an ileostomy. In fact, "yogurt, parsley, and buttermilk may decrease gas and odor" (16). Low fiber is advised for a month after the ileostomy is placed, but

slowly increasing fiber to normal levels is ideal. If they are having excessive diarrhea, they can avoid insoluble fiber (because it absorbs water) like wheat bran, nuts and seeds, and avocado, and switch to higher intakes of soluble fiber like bananas, prunes, and oatmeal. In general, they need to pay close attention to their stool to know which foods to avoid. Within eight weeks after their surgery, they should be eating a regular diet. The patient will always need to chew their food thoroughly. When the RD asked this patient if he was having problems with his ileostomy, he said no.

The patient was started on TPN after they discovered his SBO and remained on TPN for four days. The first two days, the TPN was providing 65-70% of needs (Clinimix 4.25/25 @ 63 ml/hr) with 1542 kcal & 64 g protein. The next two days, the TPN was custom made to provide 1510 kcal & 80 g protein; this was providing 68% of kcal needs and 100% of the lower end of his protein needs. The RD thought this TPN nutrition was appropriate, given his suspected malnourishment and that it was providing some nutrition as he was beginning to tolerate PO.

When this patient was in the ICU, his PES statement was involuntary weight loss related to a history of poor nutrition with colitis as evidenced by his %UBW. The interventions at this time were to advance his diet as tolerated to a 2200 ADA diet, and add Glucerna and propass applesauce BID. When he transferred out of the ICU, this PES was still true, but a new PES was added: inadequate protein energy intake related to altered GI function as evidenced by CL x 1 day. The patient was on TPN and the interventions at this time were to advance the diet to a 2200 DM diet and to add supplements when the diet allowed. A communication form that stated to advance the diet as tolerated to 2200 DM diet was left for the doctor, which was not honored until two days later. This PES remained true for the next day, except now the evidence was CL x 2 days, <50% PO intake, and TPN providing 65-70% of needs. The interventions at this time

were to maintain the current TPN for some nutrition while the patient is working towards tolerating a PO diet, but to discontinue the TPN when the patient tolerates at least 50% PO. Also at this time the RD added Glucerna BID. The next day, the PES was the same, except the evidence was that the patient was eating about 50% PO. The interventions at this time were to taper the TPN as the patient begins to tolerate at least >50% PO and to send chocolate Glucerna BID once patient was off TPN due to high blood sugars. The RD left a note for the MD to begin to taper the TPN because the patient was beginning to tolerate his diet; this was not honored until two days later. Also at this time, the patient requested information about a diabetic diet and a low fiber diet, since that was the diet he was on. The RD provided him with information and compliance was expected because the patient was engaged, mentioned he wanted to make changes, and ordered foods off the menu that were appropriate for him based on what the RD said. The next day, a different PES was initiated. The PES was now: excessive PN nutrition (PN is not indicated for this patient at this time) related to current condition as evidenced by his intake record (patient is tolerating diet, beginning to eat 75% of meals consistently; has appetite). The interventions were to discontinue the TPN because it was not indicated and to send Glucerna BID when the TPN was discontinued. The next day, the TPN was discontinued and the PES changed again because the previous PES resolved: increased nutrient needs related to metabolic stressors as evidenced by surgical incisions/pressure ulcer. The interventions at this time were to encourage PO intake, have the patient select his menu, and to send double meat portions. This PES remained the same for the next day. The interventions changed to discontinuing the double meat portions because the patient did not like it and to keep sending the Glucerna BID. The monitoring and evaluation of the patient's care plan demonstrated that the RD was successful to

achieving her goals of making sure that the patient was meeting his energy and protein needs with at least 75% PO intake, maintaining patient's LBM, and promoting his skin integrity.

Summary/Conclusion

This patient had a complicated medical history that led to a stage three empyema and required a full thoracotomy for decortication of his left lung. This was an invasive procedure, requiring more protein and energy. This patient also developed a small bowel obstruction after his surgery and required TPN. This patient also had an ileostomy, which he reported he had no problem managing. My personal impressions of this case study were that this patient was at once extremely ill and was slowly getting better. He was receptive to my suggestions for his diet and did not have a problem sharing information with me. He was very motivated to improve his health given his past.

I thought I handled the care of this patient well. If I could change something, I would have addressed his ileostomy with him more. When I asked him if he had problems, he denied it, but I should have asked more specific questions, like how much fluid he drank per day, if he ate sources of B12 like fish, milk, and breakfast cereals, and if he knew anything about the deficiencies that can occur if does not eat a balanced diet with an ileostomy. I did not give TPN recommendations to the MD because I thought that the amount it was providing was sufficient enough while the patient was also on a diet.

For my case study, I wanted to do either a respiratory of GI condition; I ended up with both in this patient. Overall, I learned much in my care and research of this patient. It helped draw my attention to the importance of correcting malnutrition in people with respiratory problems and the medical nutrition therapy for an ileostomy.

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