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Diplomate in Internal Medicine
Diplomate in Pulmonary Medicine

October 12, 2012

Re: Victorino Noval (Deceased)

I. INTRODUCTION

Victorino Noval was a 78-year-old male who died on 5/7/10. The patient had initially presented with symptoms of shortness of breath on 4/28/10 and subsequently had a diagnosis of aspiration pneumonia made. He required endotracheal intubation and mechanical ventilation for several days. Eventually, he was withdrawn from the mechanical ventilator on 5/7/10. After several hours of observation while breathing spontaneously, the patient suffered a fatal cardiorespiratory arrest and was pronounced dead in the late afternoon of 5/7/10. Several questions have been raised in this case regarding this patient's physiologic status just prior to his demise.

II. CASE PRESENTATION

Mr. Noval initially presented to Kaiser on 4/28/10, complaining of shortness of breath. The patient was found to have a low oxygen saturation at an emergency room in Desert Valley and was treated with noninvasive ventilation.

The patient's respiratory status progressively deteriorated and he was eventually intubated and mechanically ventilated. Chest x-ray on admission was unremarkable, as was the chest CT scan. In addition, the CT scan of the head also was unremarkable.

The patient was noted to be in atrial fibrillation and underwent an echocardiogram on 5/2/10. That study showed a normal left ventricular ejection fraction of 50-55%. He was subsequently treated with IV antibiotics and supportive care.

The patient developed physiologic criteria for adult respiratory distress syndrome (ARDS). His oxygen requirement was 75% FiO₂ (concentration of inspired oxygen) until midday on 5/6/10. At that point, his FiO₂ progressively reduced from 60% down to 40% in the morning hours of 5/7/10. During that time, the patient maintained a normal oxygen saturation. In addition, his blood pressure and pulse were in the normal range.

During the course of his hospitalization, reportedly several family members began the discussion of discontinuation of supportive care. Reportedly, that decision was based on the assumption that this patient's functional status would be suboptimal following his acute care hospitalization.

At 12:45 on 5/7/10, this patient was extubated and placed on supplemental oxygen. Over the next several hours, his oxygen saturation remained in the normal range, as did his blood pressure. The patient was given additional morphine at approximately 15:21 on 5/7/10. Following administration of morphine, his vital signs began deteriorating. He eventually suffered a respiratory arrest and was pronounced dead at 17:25 on 5/7/10.

III. REASONS FOR THIS PATIENT'S DEMISE

As stated previously, this patient had required mechanical ventilation throughout his entire acute hospitalization. The reason for the necessity for assisted ventilation consisted of an entity known as acute respiratory failure. This

diagnosis implies an inability of a patient to breathe spontaneously due to an acute process, such as pneumonia, as in this case. The treatment of choice in such a situation is to provide respiratory support (via mechanical ventilation) until the acute process resolves.

Mechanical ventilation is a process that involves a mechanical ventilator that provides positive pressure ventilation to support the patient's respiratory status. Normally, patients breathe spontaneously by the use of respiratory muscles. Unfortunately, in acute care situations, the workload required by the respiratory muscles exceeds their ability to provide that workload, which results in inadequate ventilation and oxygenation. Thus, the need for mechanical ventilation until the acute process subsides.

In this particular case, the etiology of this patient's acute respiratory failure was initially felt to be due to pneumonia. The clinical definition of pneumonia involves an inflammatory process that results in the filling of the alveoli (air sacs) in various sections of the lung. This then results in the inability of that particular section of the lung to participate in oxygenation and ventilation.

Unfortunately, in a small percentage of patients who develop pneumonia, the alveolar filling process (accumulation of fluid in the air sacs) progresses to involve virtually the entire lung. This then is the entity that is referred to as acute respiratory distress syndrome (ARDS). The treatment of choice in these patients is supportive care until the underlying process resolves.

The pathophysiology of ARDS dictates that a reduction in the ability of the lung to function as an oxygenator. This then requires supplemental oxygen due to the reduction in the ability of the alveoli to serve in that capacity. As ARDS resolves, the fluid in the alveoli gradually dissipates, thus, allowing the alveoli to progressively participate in the process of oxygenation.

The severity of ARDS can be estimated by the amount of supplemental oxygen delivered via the mechanical ventilator.

The FiO₂ (percent of inspired oxygen) of the ambient air is approximately 21%. In patients with severe ARDS, the oxygen requirement may be as high as 100% FiO₂. In this particular patient, the FiO₂ was 75% on the morning of 5/6/10 and was gradually reduced to 40% over the ensuing 24 hours.

The decision was made to extubate this patient (remove the breathing tube from the airway) shortly after noon on 5/7/10. At that time, the only supplemental oxygen delivery was by an oxygen mask, which provided an FiO₂ of approximately 6%. During the next several hours (until after 15:00), the patient's oxygen saturation remained in the normal range (above 92%). During that time, his blood pressure also was in the normal range.

Eventually, at approximately 15:21 on 5/7/10, the patient was given additional morphine. He had previously been given morphine for comfort during the time his ventilation was being supported by the mechanical ventilator. However, when he was given intravenous morphine on the afternoon of 5/7/10, his respiratory status began deteriorating. This would be the normal physiologic response to a narcotic, such as morphine, which acts as a respiratory suppressive. That is to say that the morphine suppresses the respiratory centers in the brain, which decreases the drive to breathe. If that process continues, these patients will eventually suffer a respiratory arrest, which will obviously be fatal if they are not resuscitated. Based on the fact pattern in this case, the intravenous morphine administered at 15:21 on 5/7/10 was the proximate cause of this patient's eventual respiratory arrest that occurred shortly after 17:00 hours.

IV. SHORT-TERM PROGNOSIS

As stated previously, this patient required mechanical ventilation during the majority of his acute hospitalization in early May of 2010. The patient was said to be suffering from chronic obstructive pulmonary disease (COPD), though had quit smoking in 1980. His last pulmonary function tests showed evidence of a moderate obstructive impairment.

As stated previously, the patient underwent an echocardiogram during his acute hospitalization, which showed a normal left ventricular ejection fraction of 50-55%. He had been hospitalized previously for episodes of chronic fatigue syndrome, though those episodes apparently were related to a cardiac arrhythmia, atrial fibrillation. The patient's left ventricular ejection fraction of 50-55% is in the normal range, which would indicate normal pump function. It is medically probable that his previous hospitalizations for congestive heart failure were due to treatable cardiac arrhythmia (atrial fibrillation).

As stated previously, this patient's ARDS was actually improving prior to the time of his extubation on 5/7/10, as was indicated by the gradual reduction in his oxygen requirements. As stated previously, his blood pressure and oxygen saturations were in the normal range during the time that his FiO2 was reduced from 75% to 40%. Thus, his cardiac and respiratory function was adequate to tolerate a marked reduction in FiO2 during the 24 hours prior to his extubation.

It is also noted that this patient's cardiac and respiratory function was able to maintain normal and normal oxygen saturation over the several hours after his extubation. That is to say that following the removal of the endotracheal tube (breathing tube) at approximately 12:45 on 5/7/10, the patient maintained a normal oxygen saturation and a normal blood pressure until the additional morphine was given at approximately 15:21 hours on 5/7/10.

Based on the physiologic data in this case, it is more probable than not (reasonably medically probable) that this patient would have survived his acute hospitalization in May of 2010, had supportive care been continued. As stated previously, his cardiopulmonary function was sufficient to tolerate a marked reduction in FiO2 between midday on 5/6/10 and midday on 5/7/10. In addition, his cardiopulmonary function was sufficient to maintain normal oxygen saturation and blood pressure for several hours after his extubation and prior to the time that the intravenous morphine was administered on 15:21 hours on 5/7/10.

V. NEUROLOGIC STATUS

This patient had a diagnosis of Parkinson's disease made prior to his acute hospitalization that began on 4/28/10. Parkinson's disease is a neurologic entity that is defined as a motor disorder. That is to say that normal movements are often erratic due to the deterioration of an inhibitory section of the brain (substantia nigra). That is to say that normally, the neurotransmitter, dopamine, produced in the cells of the substantia nigra (located in the mid brain), is responsible for modulating motor movements to ensure good muscle control.

In Parkinson's patients, the amount of dopamine produced in the substantia nigra is significantly decreased, which actually reduces the inhibitory function of several other areas of the brain that promote motor activity. The end result is erratic motor activity that leads to what is known as a resting tremor. That is to say that Parkinson's patients experience a tremor (alternating movements) of the extremities while at rest. Oftentimes, however, the tremor in these patients resolves with intentional movement.

Typically, Parkinson's patients have primarily a motor deficit. That is to say that these patients have a resting tremor that impairs normal motor activity. However, higher mental function is generally not impacted in these patients.

This patient's prior mental function is demonstrated by his functional capacity prior to his acute hospitalization on 4/28/10. Reportedly, this patient was living in his home, drove his own car, and operated his own business, which reportedly generated several million dollars per year. The patient reportedly managed his own portfolio (which was sizable) and he regularly interacted with real estate brokers. Based on this information, it is medically probable that this patient had no significant cognitive impairment resulting from his Parkinson's disease.

VI. LONG-TERM PROGNOSIS

As stated previously, the physiologic data in this case would dictate that it would be more probable than not that this patient would have survived his acute hospitalization in May of 2010, had supportive care been continued. Several questions have then been raised in this case regarding this patient's long-term prognosis had he survived his acute hospitalization.

Obviously, long-term prognosis is primarily a function of the status of the patient's cardiac function and respiratory function. Certainly, neurologic function also factors into that equation.

As stated previously, the patient's cardiac function was evaluated on echocardiography shortly after his admission on 4/28/10. At that time, his left ventricular ejection fraction was noted to be in the normal range at 50-55%. It is, therefore, medically probable that the pump function (the ability of the heart to function as a pump) was within normal limits.

This patient did have an irregular heartbeat (cardiac arrhythmia), which was diagnosed as being atrial fibrillation. This is an irregular heartbeat, which is relatively common and generally treatable. When the heart rate becomes too fast (or too slow) (as a result of atrial fibrillation), the result may be congestive heart failure, which this patient had been hospitalized for in the past. Suffice it to say, however, that congestive heart failure due to a cardiac arrhythmia, such as atrial fibrillation, is reversible, pending control of the patient's heart rate.

There is no evidence in this case that this patient suffered from coronary artery disease (plaque buildup in the coronary arteries). There is also no evidence that he had suffered acute myocardial infarction (heart attack) and had never required coronary angioplasty, stent placement or coronary bypass surgery. Thus, his cardiac status was compromised

only by an cardiac arrhythmia (atrial fibrillation). When his atrial fibrillation was under control, he appeared to have normal cardiac function.

The patient also was said to suffer from chronic obstructive pulmonary disease. This is a label used to describe smokers or former smokers and generally refers to emphysema and bronchitis. Emphysema can be viewed as destruction of lung tissue, while chronic bronchitis is defined as inflammation in the airways.

This patient's last pulmonary function tests demonstrated evidence of a moderate obstructive impairment. This would indicate that his lung function was moderately compromised as a result of his COPD. The patient also carried a diagnosis of obstructive sleep apnea. This is actually an upper airway problem that involves a collapse of the upper airway during sleep. The result is cessation of movement of air throughout the upper airways, which in turn results in progressive hypoxia and, thus, frequent awakenings. The patient was apparently being treated with nocturnal oxygen for this problem.

Based on this patient's cardiopulmonary function, there is no evidence that he would have died in the foreseeable future following his acute hospitalization in May of 2010. That is to say that it is medically probable that the clinical diagnosis responsible for his ultimate demise had not yet surfaced during his acute hospitalization in May of 2010.

VII. SUMMARY

In summary, this 78-year-old gentleman was hospitalized for treatment of his pneumonia in late April of 2010. The patient required endotracheal intubation and mechanical ventilation for respiratory support during the majority of that hospitalization. He was treated with intravenous antibiotics and supportive care. Eventually, the decision was made to discontinue supportive care and the patient was subsequently extubated shortly after noon on 5/7/10. After tolerating the extubation procedure, the patient was given

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intravenous morphine several hours later and subsequently suffered a respiratory arrest. He was eventually pronounced dead. Based on the physiological data in this case, it is medically reasonably probable that this patient would have survived his acute hospitalization in May of 2010 had supportive care been continued. It is also medically probable (based on the patient's cardiopulmonary function) that he would not have died in the foreseeable future following his acute hospitalization in May of 2010.

It has been a pleasure participating in the evaluation of this extremely complex case. If any questions should arise regarding the opinions I have set forth in this report, please feel free to contact this office.

Sincerely,

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Diplomate Subspecialty Board of Pulmonary Disease
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