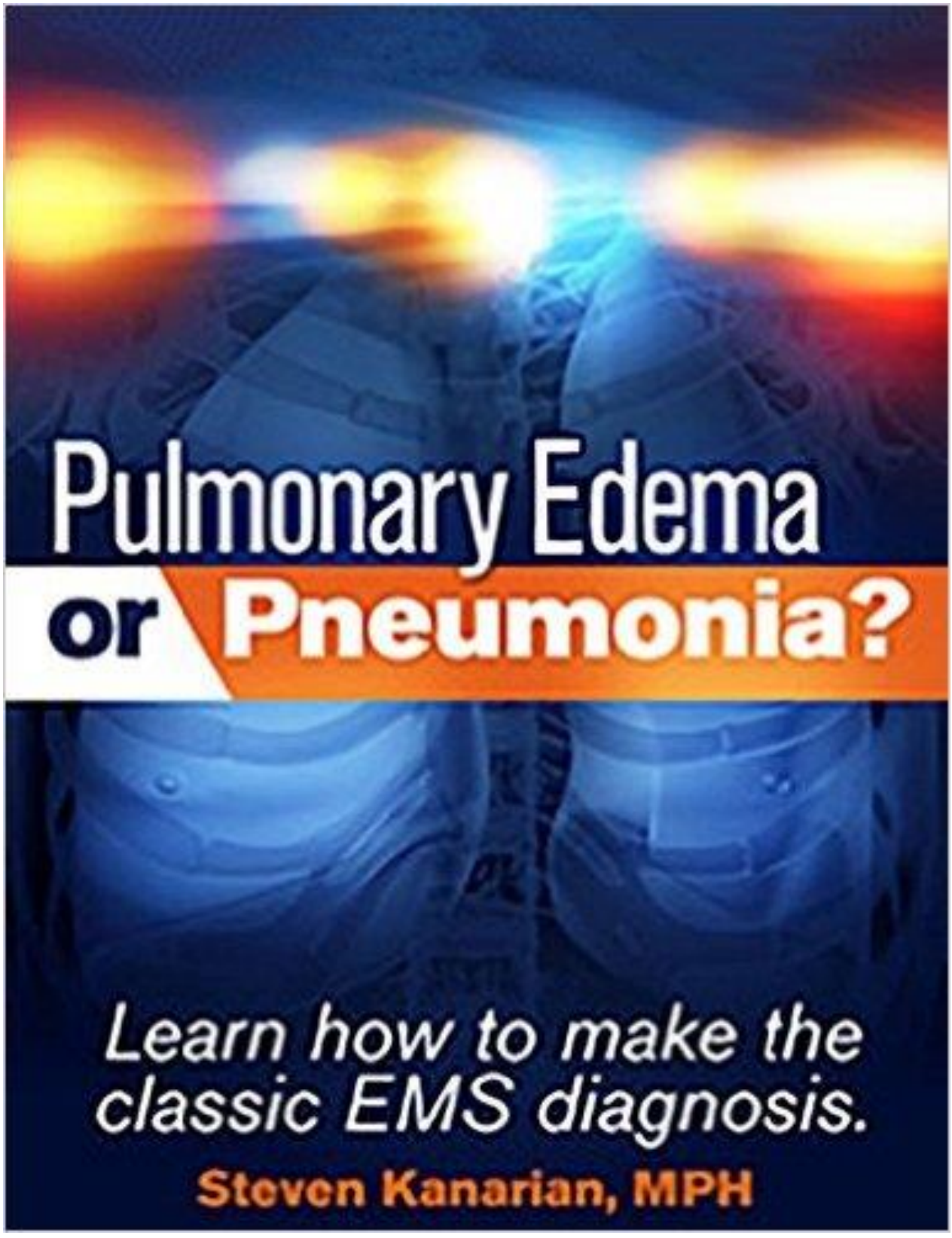


A Classic Paramedic Assessment: Pulmonary Edema or Pneumonia?

An emergency response to a patient with difficulty breathing and multiple medical problems requires the EMT or paramedic to accurately diagnose the most urgent presenting problem and deliver the appropriate treatment to benefit the patient. Performing a thorough history of present illness (HPI) and physical exam (PE) is necessary to make an accurate differential diagnosis of respiratory problems.

This information is important for EMTs and Paramedics who may not be comfortable with cardiac and respiratory patients with multiple medical problems. Make no mistake! An EMT can make the same questions and do a thorough physical exam and make a presumptive diagnosis of pneumonia or APE. Let's consider this article for EMTs and Paramedics. After all, I always say, "EMTs are future medics of the world, train them right."

As a new medic I was fortunate I had the opportunity to work with senior medics who had treated hundreds of critical cardiac and respiratory patients. My assessment and treatment was based on paramedic training and tailored by these medics and what they had learned from experience. I was also fortunate to work out of Jacobi Hospital in the Bronx where the physicians' supported paramedics and taught them the fine points of assessment and treatment. Several of these doctors had been paramedics and demanded excellence in our pre-hospital care. Through the guidance of these medics and Dr.'s Gary Lombardi, Barbara McIntosh and Chuck Martinez I learned to put the pieces of the

puzzle together and complete the diagnosis when faced with a patient with multiple problems.

In recent years the increase in paramedic availability has lowered the number of acute patients paramedics care for. This article may be particularly helpful to EMT's and paramedics who want to further their knowledge about assessment of the critical patient. Let's look at a pre-hospital case involving the differential diagnosis of pulmonary edema and the paramedic approach to make an accurate differential diagnosis between pulmonary edema and other respiratory diseases.

Case Study

You respond as with a first responder engine company to a private house at 04:04 hours for a 60-year-old female with difficulty breathing. You ask the patient, "What is wrong?" The patient replies, "I…..Ca…n't …..breathe." The patient is quickly placed on 100% oxygen via a Non-Rebreather mask by firefighters as they obtain vitals signs and place the pulse oximetry lead on the patient's finger. You reassure the patient while placing your hand on the patient's shoulder, "We are going to help you feel better ma'am. Relax and concentrate on breathing." When the family is asked about her past medical history (PMH) the husband tells you, "She has heart failure, diabetes, high blood pressure and COPD."

The history of present illness you have pieced together from the patient and family include the patients being woken out of her sleep this morning with shortness of breath,

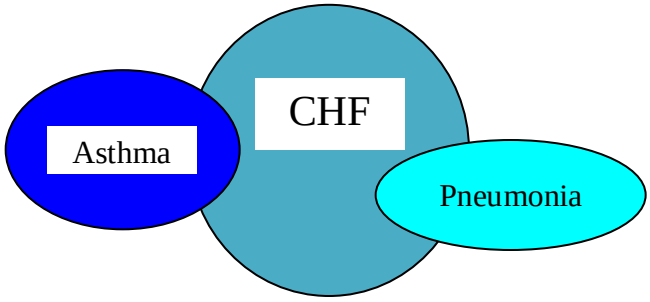
the patient has a chronic cough and has been experiencing increased shortness of breath when she walks to the corner store. You observe the patient sitting in a chair in her bedroom with her hands on her knees sitting upright, struggling to breath.

Following the history of present illness the family brings you a variety of medications the patient takes. Your partner reads off the medications, "Lasix 80 mg twice a day, Digoxin .125 mg, 1 time a day, Regular Insulin 30 Units, twice a day, Levequin and an Albuterol inhaler." The daughter interjects, "She has had water on the lungs and respiratory infection several times in the last year. She also has borderline kidney failure from diabetes." Vital signs obtained are BP 170/104, 118 and irregular, at respirations 28 and pulse oximetry reading of 89%. The patient is in atrial fibrillation with no ectopy. The 12 lead ECG obtained shows no ST elevation or abnormalities other than the atrial fibrillation.

Accurately diagnosing the emergent problem in this patient is crucial to delivering the right treatment for your patient. Failing to treat acute pulmonary edema may decrease oxygen saturation in your patient causing acidosis-requiring intubation, causing a longer ICU admission and possibly cardiac arrest. Administering Lasix to a pneumonia patient may cause dehydration and electrolyte imbalances. Contrarily treating a cardiogenic shock patient with medications for pulmonary edema will worsen the patients outcome. A clear diagnosis may not be able to be made with the information on hand at this point. Let's review the basics of respiratory assessment and the keys to making the differential diagnosis.

The Differential Diagnosis

Paramedics evaluating a patient should use a ***systematic and complete*** history of present illness, past medical history and physical assessment. Only with all the pertinent elements of each part of the pre-hospital assessment can a medic accurately determine the presenting problem and best course of treatment. The more subtle the variation of the patient's condition, the more precise the assessment and history has to be.



Respiratory Distress is often caused by overlapping medical problems.

Our diagnosis starts before we touch the patient when responding to a call for shortness of breath. While we review dispatch data we think about the time of day, location and age of the patient. A 60 year old with shortness of breath in the early morning may be a

clue the patient is in pulmonary edema. A call for a shortness of breath and fever in a nursing home may be pulling you towards a diagnosis of sepsis or pneumonia. Upon arrival we obtain information from bystanders, first responders and the family. While approaching or patient we perform our doorway assessment. During our initial impression of the patient we consider the position of the patient, the degree of difficulty in breathing and the patient's ability to speak in complete sentences. For example, responding to a home during the summer and finding a patient in the fetal position under a blanket may be an indication he or she has a fever and not necessarily asthma or APE. Multiple family member history of recent illness or travel may clue you in to problems such as carbon monoxide poisoning, H1N1 virus or SARS.

History and Physical Exam

Obtaining a history of present illness allows us to collect information on which to base our diagnosis. When collecting a patient history considering pertinent positives will help you determine the cause of the patient's complaint. Consider the Onset, Provocation, Quality of pain, Radiation, setting and Timing/Treatment (OPQRST). For example, a rapid onset of shortness of breath may be an indicator of APE or asthma. A history of recent surgery may is a risk factor of pneumonia or pulmonary embolus. When treating a patient with shortness of breath providers should ask if the patient has a cough and if the cough is productive, what color the phlegm is and if the color is a change for them. Heart failure patients may also have orthopnea, (difficulty breathing lying flat) dyspnea on exertion (DOE), and sputum which is white or white and blood tinged in color. Important questions for the heart failure patient are; "Do you sleep flat or on pillows?

Have you recently had to sleep sitting up? Have you noticed you get short of breath coming up the stairs?" These questions may point to a gradual onset of congestive heart failure (CHF).

The patient's history of past medical history may give clues to the present condition because patients often experience the same problems repetitively. The acronym SAMPLE- Surgeries, Allergies, Medications, Past Medical Problems, Last Meal and Events leading up to the issue may be very helpful. The SAMPLE questions should be used to develop a complete history of present illness. A patient who was admitted for "water on the lungs" probably had congestive heart failure or acute pulmonary edema. A patient with renal failure may have missed a dialysis appointment and be retaining fluid putting them at risk for pulmonary edema. Obtaining information about frequency of dialysis, medication and compliance are very important. Diabetes and high blood pressure are contributing factors to both kidney and heart failure.

Patients with bronchitis or emphysema will have a history of shortness of breath coinciding with a change in weather or recent infection. Determining the cause of a respiratory illness the color of a cough can be very helpful. A cough productive of green or yellow phlegm indicates an infection. Whereas a cough productive of white blood tinged sputum is classic of pulmonary edema. Patients, who are bed ridden, have had recent surgery or are post-partum are at risk for a pulmonary embolus.

Paramedic level assessment of lung sounds; heart sounds, JVD and pedal edema should be checked on every patient with Cardiac or Respiratory complaints.

cardiac or respiratory

Physical Findings

The most important aspect of your physical assessment is performing the cardio-respiratory assessment completely each time you assess a patient with shortness of breath or chest pain. Heart failure patients commonly experience, increased dyspnea on exertion over time, increased fluid retention, swelling of the ankles. A complete cardiac assessment is crucial to determining whether a patient is experiencing right sided or left sided heart failure. Nail bed clubbing, yellowish finger tips, purse lipped breathing and increased chest diameter from years of smoking is a clear indication the patient has a history of COPD.

Diagnostic tests

Diagnostic tests performed in the field include ECG, 12 lead ECG, pulse oximetry and waveform capnography in the intubated patient. A monitoring ECG is an important tool to identify life-threatening rhythms like ventricular tachycardia or supraventricular tachycardia. Rapid treatment of unstable dysrhythmia may reverse pulmonary edema when effectively treated. A 12 lead ECG will identify blocked coronary arteries in STEMI patients is crucial to resolving myocardial ischemia and preventing heart failure. Pulse oximetry will provide an indication of the percent of hemoglobin that are saturated with oxygen. Hypoxic patients may appear anxious with high levels of C02 or quiet when hypoxic. Pulse oximetry will identify those patients who are in respiratory failure and in need of oxygen and treatment to facilitate respiration. Waveform capnography is essential for monitoring patients who are intubated to confirm and monitor tube

placement. Intubated patients with lung or airway obstruction may present with abnormal wave forms indicative of airway narrowing.

Pathophysiolgy of Cardiogenic Pulmonary Edema

A normally functioning heart circulates blood to the pulmonary circulation via the right ventricle and to the left ventricle to the systemic circulation. Sufficient circulation is need from the left ventricle to provide adequate perfusion to the brain, kidneys liver and other essential organs. When circulation is impaired pathological effects inhibit the body's ability to provide oxygen and glucose to cells. Cardiogenic pulmonary edema is caused by the failure of the left ventricle to adequately pump blood to the systemic circulation. Left ventricular failure is caused by overload of fluid or ventricular strain caused by chronic high blood pressure.

As the left ventricle fails, circulation of blood slows in the left atrium, blood then backs up in the left atrium and the pulmonary artery. Increased pressure in the pulmonary circulation due to left ventricular failure causes an increased osmotic pressure in the pulmonary capillary bed. Increased osmotic pressure in the capillary bed causes fluid to diffuse into the alveoli when pressure reached 25 mmHg. The patient with pulmonary edema experiences increased respiratory distress as fluid fills the alveoli and alveolar surface area for oxygen transfer is decreased. Left sided heart failure causes bilateral rales in the bases, as pulmonary congestion increases, the level of rales rises.

"Cardiac Asthma" is a common term used in medical practice. This term is used to describe the presence of wheezing in the lungs caused by distention of the bronchial walls and bronchial narrowing prior to the flow of fluid into the alveoli causing rales and acute pulmonary edema (APE). I personally do not care for the term, but it is in widespread use and you should be familiar with the term. This bronchial swelling phase is the point of APE that is compared to asthma because of the resultant wheezing secondary to bronchiole swelling. Some providers describe the rapid filling of fluid into the lungs as a "flash over." An astute paramedic who is well versed in respiratory diseases can detect APE just prior to flashover and prepare for appropriate treatment. This determination is made by a history of sudden shortness of breath, cough, history of cardiac problems, diaphoresis and diminished lung sounds due to alveolar swelling.

Pulmonary edema fills alveoli causing a decrease in oxygen transfer to hemoglobin causing hypoxemia. Serous fluid in the alveoli causes the alveoli to fill thereby reducing the surface area available for the exchange of oxygen and carbon dioxide with the blood stream. Lack of oxygen available to essential body tissue and systems has profound effects on the patient. As pulmonary edema worsens, fluid levels in the lungs increase and dramatically reduce surface area for oxygen absorption and release of CO2. As the lungs fill with fluid, carbon dioxide builds up; hypoxia begins because of decreased tidal volume. The patient becomes anxious because of a build-up of carbon dioxide, experiencing increased dyspnea and agitation. Pulmonary edema is frequently associated with a sympathetic release which causes diaphoresis, pallor, tachycardia and anxiety. Increased sympathetic blood flow also restricts blood flow to the kidneys which respond

by reducing glomerular filtration rate and increasing the re-absorption of salt and water which increases circulating volume. This renal mechanism if, if unchecked can worsen congestion and cause overt edema (Springhouse, p. 1123). Increased pulmonary capillary hydrostatic pressure is the most common cause of pulmonary edema (Des Jardins, p. 304). Other causes of cardiogenic pulmonary edema include MI, arrhythmias, pulmonary embolus, renal failure, fluid overload, hypertension, myocarditis, valvular disease and congenital defects.

Physical Signs of Pulmonary Edema

The diagnosis of pulmonary edema is a clinical diagnosis based on physical signs, symptoms and the history of present illness. Diagnosis of APE warrants consideration of other pulmonary diseases as part of a differential diagnosis. Pneumonia, COPD and Asthma can share similar physical findings with APE at various stages. A discussion of the signs and symptoms of these diseases is essential to properly diagnose APE vs. other pulmonary diseases.

Pathophysiology of Pneumonia

Pneumonia is an acute infection of the lung parenchyma that commonly impairs gas exchange. (Springhouse Diseases, Pg. 574) Pneumonia starts with infection which causes the production of phlegm which may be yellow or green. Build up of phlegm in the alveoli slows diffusion of oxygen and carbon dioxide through the capillaries. The

body tries to fight infection by raising body temperature and expelling phlegm The patient experiences a shortness of breathe with more gradual onset over weeks rather than a short, rapid onset as in pulmonary edema. Patients at risk for pneumonia are bed-ridden patients, patients who have recently had surgery, cancer or lung disease. Pneumonia can also be cause sepsis.

Prolonged fever and hypoxia in an elderly patient with pneumonia can trigger a cascading reaction where the patient becomes dehydrated, increases pyrexia and hypoxia can cause hypokalemia, dehydration and shock in the elderly. When considering that pneumonia with fever can also reduce the amount of oxygen binding to hemoglobin shifting the oxygen hemoglobin curve to the right reducing oxygen absorption, the paramedic can appreciate the net effect sever pneumonia can have on the fluid balance, cardiac conduction and respiratory system of the patient. ***An appreciation of these symptoms and how they are interconnected will make an experienced medic less likely to look as a pneumonia call as a minor or BLS job in the elderly.*** These patients should be transported with oxygen, ECG monitoring and appropriate administration of fluid.

Summary of Key Points in Determining APE vs. Pneumonia

	APE	Pneumonia
Skin	Cool, Pale, Moist	Warm and Flushed
Jugular Veins	Normal or Distended	Normal
Heart sounds	S3 or S4	Normal

	APE	Pneumonia
Lung Sounds	Crackles, Rales	Rhonchi
Sputum	White or Blood Tinged	Yellow or Green

Fine Points of Making the Distinction

When symptoms overlap and a clear diagnosis is not immediately obvious the technique of trending can be used by paramedics to determine the patients' diagnosis and treatment. When faced with a critically ill patient who may have overlapping signs paramedics should perform repeat assessment, provide oxygen, establish IV access and obtain an ECG. When in doubt paramedics should opt to start an IV and withhold medications until the diagnosis may be clearer. Assess the patient again before removing from the building and then during transport. Over time the vitals and lung sounds may evolve and help you determine which diagnosis is most appropriate because of the trend you observe in your patient.Medical Control consultation is essential in these cases to determine the best path of treatment which may use several protocols.

Case Example:

Our case involved a 60 year old female who called the ambulance at 04:04 a.m. because of shortness of breath. She has a mixed history of cardiac disease, COPD, Diabetes and Hypertension. Her Vitals are BP-170/104, Pulse 118 irregular. Respiration's are 28, 02 Sat is 89%.

We know she is a sick patient and has a history of "fluid on the lungs" as well as COPD with a chronic cough. She is hard to diagnose with the information and incomplete HPI we have collected. We need to find out several pertinent details like is the cough productive? If the cough is productive what color is the mucous? What is her skin color, temperature and moisture? Was the onset gradual or sudden? How are her Jugular Veins and Pedal edema status? I would also like to know if she takes her Lasix daily and if she is able to urinate or gets dialysis.

We find out her cough is productive, but she does not know the color. Skin is cool, pale and very diaphoretic. Neck veins are normal and she has +2 Pedal edema. We could also watch for abnormalities if we were using wave form capnography in a cannula sensor. She coughs up white phlegm as we are reviewing our findings I would be pretty confident she is in APE with the information we have. Repeat vitals show BP- 188/120, pulse 132 respirations are 36 and she is gasping for air. We can now go ahead and give her Oxygen, Nitroglycerin, and CPAP if available and other treatment as detailed by your Medical Control physician.

Treatment is based on the medical condition and the cause. The importance of basing a diagnosis on good information, assessment and history is validated when treating a patient with multiple medical issues and acute respiratory distress. Medications administered by paramedics have different effects and may be detrimental given to the wrong patient.

Studies have shown that inappropriate treatment can be detrimental to patient outcome.

Controversies

-Lasix when given incorrectly to pneumonia patients causes dehydration, thickening of mucous and hypokalemia

-Morphine use is being limited because it suppresses respiratory drive requiring intubation which has complications itself.

Treatment should be aimed at Sitting the patient upright, reassuring and coaching the patient to breath, Nitroglycerin and CPAP in patients that can maintain an airway.

Respiratory Diseases on a Continuum of Severity

Diseases appear in patients on a continuum of severity. For example, a patient may be having an asthma attack and also be suffering from a respiratory infection. With experience providers assess and treat patients ranging from a minor asthma attack with a cough to a more severe attack with a silent chest. Diseases can e charted on a continuum from minor severity on the left to sever shortness of breath and finally respiratory rest on the extreme right side. Once a paramedic has seen the range of severity the appropriate treatment can be given which is best for each patient. Prioritizing care of multiple medical problems requires prioritizing which problems most affect a patient's survival. Medical problems such as COPD, heart failure or asthma often affect the patient at the same time. Deciding which elements to treat is the effective way to manage the patient.

Conclusion

Determining the difference between pulmonary edema and pneumonia is crucial in treating the patient correctly. The key questions of history of present illness, physical findings and past medical history are important to determining the correct respiratory problem. The care and treatment of a patient does not end when we deliver the patient to the ED. Follow up on the patients diagnosis ad in-hospital treatment are most important and the basis for continued learning, Field experience coupled with outcome and suggestions for better treatment by ED physician is the basis of integrated learning and reaching the highest levels of learning and paramedic ability. Mastering pre-hospital care requires the paramedic to perform outstanding patent care, continually learn and improve while following up on your patient's outcome.

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