ADVANCES IN ENDOSCOPY

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Fluid Resuscitation in Severe Acute Pancreatitis

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G&H Could you explain the process of fluid resuscitation and why it is occasionally overlooked in patients with severe acute pancreatitis?

ST Intravenous fluid resuscitation is often used in the management of diseases of the gastrointestinal tract in order to correct intravascular losses. Diarrhea and upper and lower gastrointestinal bleeding are examples of disorders in which intravascular volume depletion is easily recognized and aggressive hydration is administered to prevent potentially dangerous cardiovascular outcomes. It is easily recognized that patients who become tachycardic and hypotensive need to be aggressively hydrated when there is a lot of blood being lost in the gastrointestinal tract, whether from an upper or lower gastrointestinal source (melena or massive hematochezia). Even in patients with diarrhea, patients and nurses inform the clinician of copious volume losses and aggressive hydration is subsequently applied. However, in pancreatitis, the intravascular volume being lost occurs into the peritoneum, where it is hidden, making it impossible to actually see the fluid that is flowing out of the intravascular space. Liters of intravascular fluid (perhaps 5–10 liters within the first 48 hours) can be lost into the peritoneum, resulting in a profound strain to the cardiovascular system.

Acute pancreatitis results in the acute immediate onset of clinically apparent inflammation of the pancreas. In the past, by mere observation, clinicians noted that there are two types of patients with acute pancreatitis: those patients with mild disease who, after suffering a stomach ache, are released home, typically in 4–5 days, and those patients with severe disease who suffer from a myriad of complications, often leading to prolonged hospitalization, intensive care in monitored units, surgery, and possibly death. These two types of acute pancreatitis likely represent a continuum of patients who were treated differently according to their needs. Although most patients would likely recover with minimal medical care, some patients with acute pancreatitis will require interventions such as endoscopic retrograde cholangiopancreatography (ERCP) for an impacted gallstone causing biliary sepsis. Other patients will need mechanical ventilation for the development of adult respiratory distress syndrome. However, many patients will need vigorous intravenous hydration to prevent the development of pancreatic necrosis. Although clinicians can often determine which patients with acute pancreatitis need ERCP and/or mechanical ventilation, at present, it is difficult to assess which patients are more likely to suffer from inadequate hydration.

G&H What are the consequences of inadequate fluid resuscitation in severe acute pancreatitis?

ST The unrecognized intravascular fluid losses in these patients result in multiple consequences. Inadequate hydration can have obvious deleterious effects to the cardiovascular system, resulting in shock and early death. Without proper blood flow to the kidneys, a person can enter into renal failure. Intravascular fluid losses can lead to a decrease in blood flow to the intestines, where mesenteric ischemia can develop, allowing bacteria to translocate into the blood and leading to infection. It is thought that the bacteria seeding the necrotic pancreatic bed originates from this pathway. Acute pancreatitis leads to a swelling of the pancreas (edematous pancreatitis), which

causes decreased blood flow into the pancreas. Decreased blood flow causes necrosis of the pancreas, complicating the disease process further. Aggressive hydration increases intravascular volume and, thus, facilitates proper blood flow into the pancreas. Therefore, it is important to avoid necrosis of the pancreas by providing adequate aggressive hydration to maintain normal perfusion in an already edematous pancreas.

G&H What are your recommendations for initial fluid resuscitation?

ST There is no simple standard answer to this question. The amount of initial fluid resuscitation varies and depends upon how the patient presents regarding initial fluid status (vital signs), age, and underlying comorbid conditions. Certainly, a young person who is otherwise healthy and who is tachycardic and hypotensive would require aggressive volume resuscitation, with even as much as 1–2 liters within an hour, depending upon their body mass index. The patient would be monitored, focusing on the vital signs, particularly the pulse and blood pressure. On the other hand, in a person who is elderly, has a history of myocardial infarction, renal insufficiency, or renal failure, is on dialysis, and/or has a history of congestive heart failure, caution would be needed. The presence of one or more of these factors makes monitoring as important as hydration. In a person who had a myocardial infarction 3 years prior and has a relatively normal ejection fraction, aggressive hydration with at least 400–500 cc per hour can be provided. However, intracardiac catheter monitoring may be needed in a patient with moderate to severe ventricular dysfunction. The initial focus of aggressive resuscitation must be to bring the blood pressure and pulse to normal (taking into account the fact that pain from the disease and the situation of the hospitalization may contribute to some level of tachycardia). After the first 2 hours, where the initial fluid resuscitation has occurred, the goal is to decrease the blood urea nitrogen and hematocrit (hemodilution). These are markers that the correct hydration has been provided. Small decreases in both markers (2–3 points for blood urea nitrogen and/or hematocrit) over the initial 12–24 hours have been shown to be associated with significant decreases in morbidity and mortality in patients with acute pancreatitis.

G&H How cautious should gastroenterologists be when treating elderly patients with heart disease?

ST Hydration should be initiated relatively slowly in these patients, though probably more aggressively than a clinician would ordinarily believe. Although there are few data on this subject, it is my opinion that too many elderly patients with acute pancreatitis have suffered from inadequate hydration due to the fear that the hydration would lead to cardiac problems. It is extremely important to be very careful and monitor the patient closely. When in doubt, a bedside echocardiogram or intracardiac catheter can be used to monitor pressures. The goal of treatment is to maintain intravascular volume and perfusion. Overstepping the amount of fluid that an elderly patient needs should be avoided at all costs because, unlike a healthy patient who can adequately handle excess volumes with either increased cardiac output or perfusion to the kidneys with urine output, an elderly person may have complications doing this and may develop congestive heart failure and pulmonary edema. Unfortunately, the fear of providing too much fluid leads to inadequate hydration, which leads to decreased pancreatic perfusion, increased necrosis, and increased release of toxic factors (such as phospholipase A2) that lead to acute respiratory distress syndrome. Only the recognition of the early need for intracardiac pressure monitoring to guide the hydration in these high-risk patients can safeguard against this situation.

G&H At what point should gastroenterologists become involved and administer hydration?

ST The goal is early involvement. However, gastroenterologists are often not involved with initial patient care in acute pancreatitis because the patient usually first presents to the emergency room or their primary care physicians. In the absence of performing an endoscopy, gastroenterologists typically wait until the next day to see the patient. Unfortunately, 12–24 hours after inadequate fluid has been administered, the patients often have already developed signs of organ failure and necrosis, if they are going to develop severe disease. Unlike other diseases often treated by gastroenterologists, when consulting patients with acute pancreatitis, gastroenterologists should immediately address the hydration issue and then follow-up closely to assess the patient's fluid resuscitation, noting the amount of hydration that was administered over the first 6–12 hours and then determining whether the vital signs are normal, whether the hematocrit and blood urea nitrogen are decreasing, and whether the patient is producing adequate urine.

G&H Of the different types of fluid solutions, which are most suitable for large-volume resuscitation?

ST Lactated Ringer's solution is likely more suitable for large-volume resuscitation than 0.9% (normal) saline.

There are several reasons for this, though I should mention that there are no published data in the literature examining this issue in patients with acute pancreatitis. A large study by Drs. Wu, Conwell, and Banks at Brigham and Women's Hospital in Boston, Massachusetts, however, is currently beginning to look into this issue. Nevertheless, by examining other specialties' data on large-volume resuscitation, we have learned that the use of lactated Ringer's solution has a beneficial effect because of its maintenance of proper acid-base balance. Patients who receive large volumes of normal saline often develop acidosis, which can confuse the clinical picture in patients with acute pancreatitis, partly by causing abdominal pain, and also by potentially increasing pancreatic secretion. There is also the issue of the lack of potassium in normal saline; over time, patients may become hypokalemic, requiring correction.

G&H Can early and aggressive rehydration prevent pancreatic necrosis?

ST There are mixed data regarding this issue. Some studies have shown that aggressive hydration can allow the hematocrit and blood urea nitrogen to decrease. Both decreased blood urea nitrogen and decreased hematocrit have been shown to correlate with the decreased development of pancreatic necrosis and organ failure. Although further study is needed, the current consensus, based upon several human and animal studies, suggests that aggressive hydration is effective by preventing the development of a pancreatic necrosis.

G&H How long should aggressive fluid resuscitation last?

ST Again, it depends upon the patient. The goal, as mentioned above, is to monitor the initial blood pressure and pulse. Once the blood pressure and pulse have normalized, the hydration should be titrated to blood urea nitrogen and hematocrit. After a drop of 2–3 points in the blood urea nitrogen and hematocrit over the first 12–24 hours, hydration can be slowly decreased to a level that maintains appropriate urine output. Aggressive hydration (300–500 cc per hour) is most important during the first 6–12 hours, and then monitoring the blood urea nitrogen and hematocrit in the next 24 hours will help guide the rate of returning hydration to normal, based on metabolic needs and body mass index.

G&H What are the next steps in research on this topic?

ST A prospective randomized trial should be performed to help clinicians standardize the rate of hydration. This study would need to address age, body mass index, and cardiovascular and renal function. Potential targets for volume resuscitation may include the blood urea nitrogen and/or hematocrit. These studies are being initiated at Brigham and Women's Hospital, as mentioned before. Thus, rather than asking how much fluid should be given, the issue becomes targeted intravenous hydration toward certain goals, stabilizing the pulse and blood pressure to reach normal levels, getting the blood urea nitrogen and hematocrit to decrease over certain periods of time, and then comparing this to change the morbidity and mortality. In addition, further study evaluating the type of isotonic solution used and even the possibility of using plasma volume expanders is needed.

Suggested Reading

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