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Fluid stewardship in hospitalized COVID-19 patients: Walking on the rope?

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Abstract: **Physicians involved in the treatment of COVID-19 hospitalized patients should be aware of fluid management in this field. Although fluid resuscitation would be lifesaving in the early phase of severe or critical COVID-19, aggressive replacement could be more troublesome, especially in patients already complicated with acute respiratory distress syndrome or myocardial injury during the course of COVID-19 or suffering from pre-existing kidney or cardiac dysfunctions. Therefore, fluid stewardship could be the optimal approach in these patients.**

Keywords: **COVID-19, Fluid management, Fluid Stewardship.**

1. INTRODUCTION

After one year of covid-19 pandemic, still there is no consensus treatment guideline is widely accepted. Patients with COVID-19 are vulnerable to volume loss via insensible routes because of high fever or apparent routes such as diarrhea and vomiting. Although fluid management in most of these patients is not a major problem, however in critical patients admitted in the intensive care unit (ICU), is a matter of concern. The management of these patients when complicated with acute respiratory distress syndrome (ARDS), acute kidney injury (AKI) or myocardial injury would be more challenging. (1,2)

Critical COVID-19 patients admitted in the ICU with hemodynamic instability are usually facing aggressive fluid administration. Fluid resuscitation remains as one of the cornerstones of sepsis management over the first hour. (3) Recent studies raised some debates about the safety of this approach. (4) Thus, fluid stewardship should be taken into account in the care of critical COVID-19 patients, especially if they are complicated with ARDS or AKI.

Liberal fluid administration is devasting in COVID-19 related ARDS which is characterized by pulmonary edema resulting from increased capillary permeability, making these patients even more vulnerable to resuscitation-induced lung congestion. (5)

On the other hand, kidneys in severe COVID-19 could be affected in different ways. In a subset of patients vomiting and diarrhea develop and they are vulnerable to pre- renal azotemia and AKI due to intravascular volume depletion that warrants early aggressive fluid resuscitation is necessary. Acute tubular necrosis is another cause of AKI in COIVID-19 patients which is due to direct cellular injury via ACE-2, hypovolemic shock or cytokine storm. (6) The third cause of

AKI -congestive renal failure- is due to rise in the kidney intra capsular pressure following to liberal fluid resuscitation. (7)

consecutively, recent evidences have shown aggressive fluid administration can results negative effects on outcome of critical COVID-19 patients l. (8,9) Several studies have shown better outcome with conservative fluid management compare to liberal fluid administration in patients with ARDS. (10,11)

We advise to divide fluid management during shock into two different stage: first stage (escalation) in order to fast fluid replacement to maintain intravascular volume, and second stage (de-escalation) to provide negative fluid balance. (12) Studies have shown that both interventions improve patient survival. (13,14) However, Studies have shown conflicting results regarding loop diuretics administration in de-escalation stage. (15,16) Therefore, some experts advise for early use of renal replacement therapy (RRT), especially in critical patients facing severe volume overload. (17) Several organizations and professional societies have published guidelines on fluid management in patients with COVID-19. A brief review of these guidelines summarized below:

2. SURVIVING SEPSIS CAMPAIGN RECOMMENDATIONS [18]

The Surviving Sepsis Campaign group has suggested the following in their COVID-19 specific guidelines for acute resuscitation of adults with shock:

1. Measuring dynamic parameters to assess fluid responsiveness (weak recommendation; low quality of evidence [QE]),

2. Using a conservative fluid administration strategy (weak recommendation; very low QE),

3. Using crystalloids in preference to colloids (strong recommendation; moderate QE),

4. Balanced crystalloids preferred over unbalanced crystalloids (weak recommendation; moderate QE).

3. NIH RECOMMENDATIONS [19]

1. No direct evidence addresses the optimal resuscitation strategy for patients with COVID-19 and shock. For adults with COVID-19 and shock, NIH guideline recommends using dynamic parameters, skin temperature, capillary refilling time, and/or lactate levels over static parameters (e.g., central venous pressure, mean arterial pressure). to assess fluid responsiveness.

2. For the acute resuscitation of adults with COVID-19 and shock, the NIH recommends using buffered/balanced crystalloids over unbalanced crystalloids, although still there is a debate

3. For the acute resuscitation of adults with COVID-19 and shock, the Panel recommends against the initial use of albumin for resuscitation.

4. WORLD HEALTH ORGANIZATION RECOMMENDATIONS [20]

1. Use a conservative fluid management strategy for ARDS patients without tissue hypoperfusion.

2. In resuscitation for septic shock in adults, give 250–500 mL crystalloid fluid as a rapid bolus in the first 15–30 minutes and reassess for signs of fluid overload after each bolus.

3. If there is no response to fluid loading or if signs of volume overload appear, reduce or discontinue fluid administration.

4. Consider dynamic indices of volume responsiveness to guide volume administration beyond initial resuscitation based on local resources and experience. These indices include passive leg raises, fluid challenges with serial stroke volume measurements, or variations in systolic pressure, pulse pressure, inferior vena cava size, or stroke volume in response to changes in intrathoracic pressure during mechanical ventilation.

5. Starches are associated with an increased risk of death and acute kidney injury compared to crystalloids. The effects of gelatins are less clear, but they are more expensive than crystalloids. Hypotonic (vs isotonic) solutions are less effective at increasing intravascular volume. Surviving Sepsis also suggests albumin for resuscitation when patients require substantial amounts of crystalloids, however this conditional recommendation is based on low-quality evidence.

In conclusion, fluid stewardship, as with antibiotic stewardship, can improve outcome of critically ill patients.

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