Book

Systemic Inflammatory Response Syndrome

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Excerpt

Systemic inflammatory response syndrome (SIRS) is an exaggerated defense response of the body to a noxious stressor (infection, trauma, surgery, acute inflammation, ischemia or reperfusion, or malignancy, to name a few) to localize and then eliminate the endogenous or exogenous source of the insult. It involves the release of acute-phase reactants, which are direct mediators of widespread autonomic, endocrine, hematological, and immunological alteration in the subject. Even though the purpose is defensive, the dysregulated cytokine storm can cause a massive inflammatory cascade leading to reversible or irreversible end-organ dysfunction and even death.

SIRS with a suspected source of infection is termed **sepsis**. Confirmation of infection with positive cultures is therefore not mandatory, at least in the early stages. Sepsis with one or more end-organ failure is called **severe sepsis,** and with hemodynamic instability despite intravascular volume repletion is called **septic shock**. Together they represent a physiologic continuum with progressively worsening balance between pro and anti-inflammatory responses of the body.

The American College of Chest Physicians/Society of Critical Care Medicine-sponsored sepsis definitions consensus conference also identified the entity of **multiple organ dysfunction syndrome (MODS)** as the presence of altered organ function in acutely ill septic patients such that homeostasis is not maintainable without intervention.

Objectively, SIRS is defined by the satisfaction of any two of the criteria below:

- Body temperature over 38 or under 36 degrees Celsius.
- Heart rate greater than 90 beats/minute
- Respiratory rate greater than 20 breaths/minute or partial pressure of CO2 less than 32 mmHg
- Leucocyte count greater than 12000 or less than 4000 /microliters or over 10% immature forms or bands.

In the pediatric population, the definition is modified to a mandatory requirement of abnormal leukocyte count or temperature to establish the diagnosis, as abnormal heart rate and respiratory rates are more common in children.

To summarize, almost all septic patients have SIRS, but not all SIRS patients are septic. Kaukonen et al. explained exceptions to this theory by suggesting that there are subgroups of hospitalized patients, particularly at extremes of age, who do not meet criteria for SIRS on presentation but progress to severe infection and multiple organ dysfunction and death. Establishing laboratory indices to identify such subgroup of patients and the clinical criteria that we currently rely upon

has been gaining prominence over recent years.

Several scores exist to assess the severity of organ system damage. The Acute Physiology and Chronic Health Evaluation (APACHE) score version II and III, Multiple organ dysfunction (MOD) score, sequential organ failure assessment (SOFA), and logistic organ dysfunction (LOD) score are to name a few.

History

With the advent of new concepts in pathophysiology and therapeutic interventions for sepsis in the early 90s, there was an increasing need to identify a homogenous group of potential subjects for clinical trials investigating new innovative therapeutic strategies. Borne out of the plethora of emerging studies, one opinion was unanimous. An early, time-sensitive approach to diagnosis and intervention is necessary to impact patient survival and morbidity significantly. Identifying the subjects at any setting with easy-to-use standardized parameters, therefore, held the key. The American College of Chest Physicians/Society of Critical Care Medicine-sponsored sepsis definitions consensus conference held in Chicago, Illinois in August 1991 aimed to establish a standard group of clinical parameters to identify those subjects in any clinical setting easily. Thus was born the SIRS definition.

It underwent further modification in the second chapter of the meeting in 2001 in Washington, DC. This conference proposed a conceptual framework of the staging of sepsis using the PIRO acronym (predisposition, insult or infection, response, and organ dysfunction).

The goal of the initial definition was to be highly sensitive using easily available parameters across all healthcare settings. An unavoidable corollary of such a definition was, therefore, the lack of specificity. A few more relevant pitfalls of the SIRS definition, as has been pointed out in the literature, include the following:

1. The universal prevalence of the parameters in an ICU setting
2. Lack of ability to distinguish between beneficial host response from pathologic host response that contributes to organ dysfunction
3. Distinguishing between infectious and non-infectious etiology purely based on the definition
4. Lack of weight to each criterion – e.g., fever and elevated respiratory rate have precisely the same significance as leukocytosis or tachycardia by the SIRS definition.
5. Inability to predict organ dysfunction.

Kaukonen et al., in their study of over 130000 septic patients, established that one out of eight patients in their observational study of sepsis did not have two or more SIRS criteria. They also established that each criterion in the SIRS definition does not translate to an equivalent risk of organ dysfunction or death.

In the wake of this debate, in 2016, the European Society of Intensive Care Medicine and the Society of Critical Care Medicine (SCCM) created a task force that proposed Sepsis-3, a new definition for sepsis. The new definition excluded the establishment of SIRS criteria to define sepsis and made it more nonspecific as any life-threatening organ dysfunction caused by the dysregulated host response to infection. The task force claimed that sequential organ failure assessment (SOFA) has a better predictive validity for sepsis than SIRS criteria. It has better prognostic accuracy and the ability to predict in-hospital mortality. To reduce the complexity of calculating the SOFA, they introduced q SOFA.

Q SOFA

3 component assessment system with:

- Systolic blood pressure below 100 mm Hg
- Highest respiratory rate exceeding 21
- Lowest Glasgow coma score under 15

Although the validity of q SOFA is limited in an ICU setting, it has consistently outperformed SIRS criteria in predicting organ dysfunction in a non-ICU and ER setting. The use of vasopressors, mechanical ventilation, and aggressive therapeutic interventions in ICU limit the efficacy of q SOFA.

Interestingly Hague et al., in their study of the utility of SIRS criteria in gastrointestinal surgery, patients also found it a useful criterion to identify postoperative complications.

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