

THIRD SPACE WHERE ART THOU?

Tanya Anand MD MPH
Ruby Skinner MD FACS FCCP FCCM

INTRODUCTION

As surgical and critical care has advanced, so have resuscitation practices. This evolution stemmed from the curiosity with perioperative fluid distribution and its relationship to the degree of surgical stress. The concept and the existence of the third space had been a popular subject matter for a number of decades, and rightfully so, as it impacted the effect that a given fluid infusion may have, upon a patient. The idea of another compartment for intravascular fluid to distribute, gave us an explanation for extra-cellular fluid distribution in a non-functional space; though did focus on the important topic of capillary leak.

OBJECTIVES

To review the historical significance of the extravascular "third space".

METHODS

A PUBMED literature search was conducted including the terms 'interstitial space', 'third space' and 'history'.

DISCUSSION

Perioperative fluid management and its association with extracellular extravascular fluid redistribution has historically been studied through animal models and human experiments. In the 1960s, Shires utilized tracers to study the relationship between the degree of surgical stress and its relationship to fluid distribution. In his experiments, he noted a greater decrease in functional extracellular fluid in patients who had undergone a greater degree of surgical stress, thus leading to the conclusion of an internal redistribution of intravascular fluid. Splenectomized dogs and humans were also noted to have a 'disparate reduction of extracellular fluid' that could not be 'accounted for' by external blood loss alone or by the shift of the extravascular extracellular fluid into the intravascular space. The concept of 2 liters of crystalloid to be given prior to blood for treatment of hemorrhagic shock evolved from this early data and has been the predominant mode for resuscitation for over 3 decades. Resuscitation strategies have evolved away from the excessive uses of crystalloid to whole blood component replacement with the avoidance of crystalloid, as military and civilian data has demonstrated improved survival and decreased morbidity when crystalloids are limited and blood loss is replaced with blood components mimicking whole blood

CONCLUSIONS

The concept of the third space impacted fluid resuscitation practices and altered our perception of fluid distribution during acute surgical/traumatic stress. Its acceptance was important in our understanding of how various fluids distribute within different spaces, and how our body reacts to stress. Additionally, it changed the manner in which we viewed hemorrhage and the necessary resuscitation that followed. This knowledge also contributed to defining endothelial dysfunction, fluid losses and retention associated with severe sepsis. Modern concepts of resuscitation and advanced critical care techniques have evolved to counteract the need to "replace" extracellular losses with large volumes of crystalloid. Whole blood component replacement is now considered to be physiologic.

REFERENCES

- CANNON WB. THE COURSE OF EVENTS IN SECONDARY WOUND SHOCK. *JAMA*. 1919;73(3):174-181. doi:10.1001/jama.1919.02610290016008
- Frost EA. [The rise and fall of the third space: appropriate intraoperative fluid management](#). *J Med Assoc Thai*. 2013 Aug;96(8):1001-8. PubMed PMID: 23991609.
- SHIRES T, COLN D, CARRICO J, LIGHTFOOT S. [FLUID THERAPY IN HEMORRHAGIC SHOCK](#). *Arch Surg*. 1964 Apr;88:688-93. PubMed PMID: 14107023.
- Moore FD, Shires G. [Moderation](#). *Ann Surg*. 1967 Aug;166(2):300-1. PubMed PMID: 6029581; PubMed Central PMCID: PMC1477384.