The use of high fidelity simulators to facilitate teaching of the diagnosis and treatment of circulatory shock

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This demonstration will illustrate the use of a high fidelity simulator in the teaching of the applied cardiovascular pathophysiology of shock. Traditional teaching of the recognition and management of circulatory shock is commonly performed either in a lecture or seminar format. Although this is a clinical problem in applied circulatory pathophysiology, the concept of a clinical demonstration of the differential diagnosis and management of circulatory shock has hitherto generally been considered as impractical. These patients are critically ill, and usually present a times incompatible with undergraduate teaching. The clinical burden of these patients is considerable, in the United States just under a million patients a year require hospitalization for acute heart failure[1], with a 5 year mortality of 50%[2]. The ultimate function of the cardiovascular system is to deliver an adequate supply of oxygen and nutrients to tissues and remove the consequent waste products. However, the system is complex, with multiple regulatory control mechanisms to such as the baroreflex for example. Because of the ease of its measurement, maintenance of arterial blood pressure is frequently seen as an indication of adequacy of circulatory function. This misconception[3] has arisen because of the absence of a readily available, non-invasive, measure of cardiac output. In disease states there are multiple causes that can lead to failure of the cardiovascular system. Frequently these disease states are grouped into broad pathophysiological categories such as hypovolaemic, distributive and cardiogenic shock. The underlying pathophysiology of these different categories can be diametrically opposed, leading to widely different clinical approaches to treatment. The inappropriate application of a treatment strategy for hypovolaemic shock to cardiogenic shock might lead to a fatal patient outcome. Understanding the underlying pathophysiology enables the evaluation of the treatment plan in terms of whether it is likely to reverse the pathophysiological processes, and therefore optimises patient care.

The underlying pathophysiology in many forms of shock has been very well known for more than twenty years. In clinical medicine the ability to recognise these different disease processes is critically important; the treatments used are generally directed at reversing the pathophysiological abnormalities. In critical care it has long been recognised that there are substantial differences in the physiological values in survivors and non survivors[4], and early optimization of the circulation can under certain circumstances lead to an improvement in survival[5].

The use of a high fidelity human simulator has many attractions, not least that the students can expand their knowledge base by observing the effects of different treatments on a given patient. The ability to wind the clock back if a treatment is unsuccessful; following a discussion of the pathophysiology the student can then explore their new knowledge, something that would be impossible, and unethical with a real patient; with a simulated patient these issues do not apply. In order to facilitate learning, the simulator can be programmed to simulate patients with pure forms of shock, rather that the hybrid forms that may present in an ever aging population.


Where applicable, the experiments described here conform with Physiological Society ethical requirements.