Abstract

OPTIMISING HAEMODYNAMICS IN THE SHOCKED CHILD – THE DANGERS OF APPLYING ADULT PARAMETERS TO CHILDREN

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The shocked child is a highly demanding paediatric emergency. The adoption of early goal directed therapy (EGDT) in resuscitation to improve the haemodynamic status of the patient has resulted in a dramatic reduction in morbidity and mortality in both adults and children, particularly in the areas of the septic shock syndrome. The most important physiological variables to assess in the critically ill patient, apart from heart rate and blood pressure, are the cardiac output (CO), cardiac index (CI), stroke volume (SV), systemic vascular resistance (SVR) and oxygen delivery (DO_2). Measurement of these parameters, even in adults, has always involved a high degree of invasiveness, as in the pulmonary artery catheter, or relatively poor accuracy with low invasive devices such as the transoesophageal Doppler. The significant dangers and difficulties of using such invasive monitoring have largely precluded their use in the sick child. In addition, there is very little published data regarding typical values of these parameters in normal children, due to the highly invasive nature of the investigations required and the inevitable distortion of the data that results from the pain and anxiety of performing the measurements. In consequence, many of the therapeutic goals used in the shocked child are extrapolations from adult observations and treatment protocols. The advent of the highly accurate yet entirely non-invasive ultrasonic cardiac output monitor (USCOM) permits the rapid (less than 5 minutes) determination of CO, CI, SV, SVR and DO_2. The data can then be used to institute early goal directed therapy and for regular monitoring to ensure that haemodynamics are optimised.

We studied 100 children from 1 to 16 years of age using the USCOM to evaluate normal haemodynamics. We found that there were major differences between the typical values found in children and those in adults. The cardiac index for example in our subjects was typically 4.2 – 4.4 L/min/m^2 or almost double that quoted for adults. Similar disparities were identified for CO, S, SVR and DO_2. The often-quoted use of pulse pressure as an indicator of SV and CO was shown to be unsupportable in our subjects, with no statistical correlation between pulse pressure and these haemodynamic parameters. We suggest that in the case of the shocked child, extrapolation for haemodynamic values derived from adult investigations are largely inappropriate and potentially dangerous, with serious risk of inadequate treatment of the child.

Suggested goals for optimizing haemodynamics in children will be presented and contrasted with values typically quoted for adults.

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