Introduction and Background
Contrast enhanced (CE) CT is vital for evaluating injuries and abnormalities. Tissue enhancement is visualised through the multi-phases of blood flow (arterial, parenchymal, portal-venous and venous). A split-bolus of contrast (2 volumes of iodine based X-ray dye) is pumped and scans performed to ‘catch’ contrast as it travels through the body using a multi-slice CT scanner (MSCT). However patients may be scanned twice to highlight correct phases, exposing them to double the radiation.

This is a significant concern in paediatric scanning as children are more vulnerable to radiation effects\(^1\). Using a different technique we could scan a region of interest (ROI) once and still achieve dual/three-phase enhancement\(^2\). As a CT radiographer working in a children’s hospital I sought to develop a more appropriate protocol.

Camp Bastion Protocol (CBP) - currently promoted for all ages
CBP\(^3\) aids diagnosis of acute adult blast injuries, image quality is acceptable for battlefield scanning and the ROI is scanned once. But, contrast volumes, flow rates and ROI’s scanned do not maximise parameters required for quality paediatric scanning. However, the protocol is routinely promoted for dynamic enhancement for all ages and a weight based contrast ‘wheel’ (figure 1) is used. CT scan commences at 70 sec. from initial injection, irrespective of individual arterial/venous flow rates.

Scan protocol:
2/3 contrast volume injected at slow rate x, and 1/3 volume injected at approximately 2x. Contrast rates are calculated for injection phase to last 70 secs. Scan initiated at 70 seconds.

Pitfalls of CBP for Paediatric Imaging
Blood circulation times vary (for children, 20-25 sec. arterial, and 45-65 sec. venous), so scanning at 70 sec. may be too late. Density of iodine at low flow rates also means minimum enhancement. CBP, though, is of benefit in departments that only have a single headed injector. For general and especially dedicated paediatric departments, with a dual headed system, this protocol is suboptimal for image quality and ROI’s scanned. Children are subjected to an examination which, in the vast majority of cases, is inappropriate and substandard. It does not fully compensate for increased blood flow rates or utilise best scanning parameters.

New Method for Paediatric CE Imaging - RHSC Trauma/Split-Bolus Protocol
Best enhancement is achieved if patient weight and appropriate flow rates\(^4\) are considered along with scanning parameters. Consequently a CT protocol (image 1), data tables (tables 1 & 2) and pre-set pump parameters (image 2) have been devised. Now pre-calculated specific contrast volumes and scan initiation times are available. These reflect more accurately the expected arterial or venous enhancement times (images 3, 4 & 5).

References