Audit Title

Assessment of inter-patient variability in hepatic enhancement at abdominal CT using lean body weight for intravenous contrast dosing.

Descriptor

Comparison of the coefficient of variability (CV) in hepatic attenuation difference (HAD) between our current total body weight (TBW) dosing with estimated lean body weight (LBW) dosing. Can lean body weight dosing provide less variability in hepatic enhancement by taking into account differences in body composition?

Background

The audit was conducted to assess whether the variability of hepatic enhancement in uniphasic CT of the abdomen could be reduced by switching to a dosing regimen based on Lean Body Mass, and therefore reduce the total amount of contrast required to obtain satisfactory enhancement reliably.

Audit Target

100% of all cases.

Method (what data is collected and how it is collected)

The first phase of our audit was retrospective. 100 cases were considered, excluding cases when:

- they were not performed on a modern CT scanner with automatic control of kVp
- the patient's mass exceeded 115 kg (the level required to maximize contrast dose at our site).
- there was underlying pathology to confound normal attenuation.
- technical factors limited measurement of attenuation (i.e. streak artifact).
- the patient's height was not available.

A control scan was obtained through the liver before the administration of contrast. The contrast was dosed according to the routine dosing practices at our institution (1.3cc / kg TBW). The images were obtained according to usual protocol, in the portal venous phase.

The second phase was performed prospectively and thus required patient consent. Consent was obtained in writing, and the patients' heights and weights were recorded.

Cases were excluded as in phase I (see above). Estimated lean body weight was calculated, and contrast was dosed by LBW (1.9cc / kg LBW). As in the first phase, a control scan was obtained through the liver before the administration of contrast. Enhanced images were obtained in the portal venous phase, as per the usual protocol.

Pre- and post- contrast liver attenuation was measured by drawing 3 regions of interest on 1) a single axial "scout" image of the liver acquired prior to administering contrast, and 2) the same corresponding location in the liver on the post-contrast portal venous phase. The mean hepatic attenuation difference was calculated.

Intervention / Action Plan / Suggestions for Change

Tailoring the LBW contrast dose may be helpful. Our estimate of the needed contrast dose / lean kg was based on the LBW determined in our first phase. Under LBW dosing, average HAD was 63HU, which exceeded our target of 50HU. Men and women may not necessarily benefit from the same contrast dosing, even when using LBW estimates.

Resources Required

The audit was conducted using the existing caseload of uniphasic abdominal CTs, which were performed on our two modern Siemens CT scanners. Assistance was provided by our research personnel in obtaining ethics board approval for the portion of the study that was prospective, and we received guidance with our statistical analysis from a statistician within the department.

Time Required to Perform the Audit

The audit was conducted between July 2016 and March 2017.

References

Awai et al. The Optimal Body Size Index with Which to Determine Iodine Dose for Hepatic Dynamic CT. Radiology: Volume 000. 1-9

Ho et al. Determining Contrast Medium Dose and Rate on Basis of Lean Body Weight. Radiology: Volume 243: Number 2—May 2007

Kondo et al. Abdominal Multidetector CT in Patients with Varying Body Fat Percentages. Radiology: Volume 249: Number 3 872-977

Kondo et al. Body Size Indexes for Optimizing Iodine Dose for Aortic and Hepatic Enhancement at Multidetector CT. Radiology: Volume 254: Number 1 163-169

Kondo et al. Body size indices to determine iodine mass with contrast-enhanced multi-detector computed tomography of the upper abdomen. Eur Radiol (2013) 23:1855–1861

Kondo et al. Body Size Indexes for Optimizing Iodine Dose for Aortic and Hepatic Enhancement at Multidetector CT. Radiology: Volume 254: Number 1—January 2010

Marin et al. Hypervascular Liver Tumors: Low Tube Voltage, High Tube Current Multidetector CT during Late Hepatic Arterial Phase for Detection. Radiology 251 (2009): 771-779

Tanaka et al. Should the dose of contrast medium be determined solely on the basis of body weight regardless of the patient's sex? Jpn J Radiol (2011) 29:330–334