LOW AND ULTRA-LOW DOSE CT ENTEROGRAPHY:
A CHANGE IN CROHN’S DISEASE IMAGING PARADIGM?
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1. Background
Both CT enterography (CTE) and MR-enterography (MRE) have established and evolving roles in current and future Crohn’s disease (CD) clinical practice and clinical trials (please see full e-poster EF-081). MRE is currently seen as the most appropriate test to monitor the disease. However, due to recent technical advances in CT technology, CTE can be performed with doses as low as <1-2 mSv with maintained accuracy (Murphy). This is a dramatic game change, a fantastic test can now be done with doses on par with a plain film series. These dose levels are very likely not associated with any increased incidence of malignancy (IN DEFENSE BODY CT). With MRE access being limited in numerous institutions, we believe low dose CTE may have a key role in CD.

2. Imaging Findings/Procedure Details
In our institution, the most recent scanners are equipped with AIDR 3D® (Toshiba Medical Systems,) a hybrid iterative reconstruction (IR) algorithm for performing noise reduction in the raw data and image domain. CTEs are performed with automatic tube current modulation, which reduces milliamperage to reach a specified noise level (SD) on the basis of the anticipated noise reduction achieved with IR. The IR technology allows for dramatic dose reduction and has a significant impact in low dose CTE’s sensitivity and specificity (figure 13) and image quality (Figure 14).

Rimola et al. demonstrated that MRI is accurate for detecting the presence of severe fibrosis in Crohn’s strictures, using the percentage of enhancement gain and the pattern of enhancement at a 7 minutes delayed phase. While other MRI parameters cannot be assessed with CT (T2 signal, for instance), delayed enhancement can. In sporadic older patients with strictures, we have performed an ultra-low dose 7 minutes delayed phase covering only the stricture (not an entire 2nd acquisition) and the results are promising. With acquisitions ≤0.5 mSv (in pair with a plain film dose), we may be able to determine which strictures have a significant percentage of fibrosis (Figures 15-20).

A “model-based” IR algorithm named FIRST® (Forward projected model-based iterative Reconstruction Solution) has been recently released by the same manufacturer (Figure 21) and may help even further. This algorithm is computationally more intensive and takes currently approximately 3 minutes to reconstruct a CT of the abdomen. However, it is more sophisticated than AIDR 3D® and seems to be able to allow further dose reduction and to accomplish increased spatial and contrast resolution (Figures 22-25).

3. Conclusion
CT enterography is a fantastic technique, traditionally limited by the utilization of high doses of ionizing radiation. However, with IR CTE may currently be performed in most patients with doses similar to a plain film series without compromising diagnostic accuracy. In institutions where access to MR is suboptimal, low dose CTE has a rapidly increasing role in Crohn’s imaging, even for indications typically assigned to MRI, like the evaluation of strictures or surveillance.

4. References
1. Murphy, KF et al., Model-Based Iterative Reconstruction in CT Enterography. AJR 2015;
2. McGillicuddy, C et al., In defense of body CT. AJR 2009;