The Continuing Hype About Hyper Signals

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Increased signal intensity ratios of specific brain regions (dentate nucleus-to-pons and globus pallidus-to-thalamus) on non-enhanced MRI images have been associated with multiple exposure to MRI contrast agents.

\textbf{Questions?}

- Is there an association between \textbf{multiple} (≥5) doses of specific brands of MRI contrast agents and the presence of \textbf{hyper intense} areas on non-contrast enhanced brain images in the Tayside population?
- Are hyper intensities dependent on the \textbf{chemical structure} of the contrast agent?
- Do some contrast agents remaining in other areas of the body after imaging? \textbf{Bone, liver, heart}?
- What is the effect in \textbf{at risk} populations? \textbf{Paediatrics}?
- Do \textbf{other imaging methods/analysis techniques} also show these hyper intensities?

\textbf{Background}

- MRI contrast agents are comprised of an ion of Gadolinium and an organic molecule. There are 2 different structures; \textbf{linear (L)} and \textbf{macrocyclic (R)}.

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- Contrast is used in approximately \textbf{1 in 3} scans, most commonly brain, cardiac and angiography.
- Studies have shown that Gadolinium from some agents \textbf{remains in the body after imaging}.
- It is displayed as “bright spots” on subsequent non-enhanced brain images.
- The clinical significance is, as yet, unknown.

\textbf{Future Work}

- Using our \textbf{in-house electronic database} of all contrast enhanced MRI exams performed in Tayside since 2004 (see poster by C. Ooi), the Dotarem cohort has been identified and analysed.
- Comparisons to images from \textbf{two control cohorts} must now be made. One in which patients have been exposed solely to linear agents and one of patients having had multiple non-contrast exams.
- \textbf{Texture analysis} is a method to quantify surface intensity variation and may prove to show any deeper changes in tissues caused contrast agents.
- \textbf{Phantom validation} work shall also be performed to assess whether the signal intensity ratios are affected by differing scanner parameters.

\textbf{Study}

- Signal intensity is found for various regions, and \textbf{ratios calculated}, at each imaging instance available in order to assess the \textbf{evolution} of any hyper signals present.

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- Differences between final (latest scan) and baseline (first) signal intensity ratios are compared for \textbf{different contrast agent} exposure and the \textbf{control} cohort.

Through \textbf{HIC} patients shall be linked to their \textbf{biochemistry} records to assess the \textbf{tolerance} of Dotarem, particularly in \textbf{at risk} populations.

Immunological testing and A&E records will show the incidence of \textbf{adverse reactions} while blood tests will indicate impact on \textbf{renal function}.

Adapted from: McDonald, R. J. et al. Radiology 275, 772-782 (2015)