Patient-dose audit and subsequent optimisation of CT aortic angiograms

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Introduction

A routine patient-dose audit of CT studies was carried out at our institution. This showed that the doses for all examinations apart from CT Aortic Angiograms were within the recommended national reference dose (NRD) levels[1] (figure 1). This group of patients was looked at in more detail. Although the subsequent dose after filtering out large area scans (such as those including peripheral run-off and thoracic studies) was found to be within the NRD, changes were nevertheless made to reduce cumulative patient doses.

Methods

Study information, including date, procedure name and dose-length product (DLP), was exported from OpenREM[2] for adult CT studies carried out using a Siemens Definition AS scanner between June and August 2014. Analysis showed that the mean DLP for CT Aortic Angiogram studies was 1170 mGy.cm (n=45), exceeding the NRD for this type of examination (1040 mGy.cm) (figure 1). As a result, a larger number of CT Aortic Angiogram studies was analysed in more detail (n=70). Each study was viewed on PACS and scans that included larger areas such as peripheral run-off or the thoracic aorta (for aortic dissection) were excluded. Patients with a diameter larger than 500 mm were also excluded.

Results and discussion

The mean DLP of the filtered dataset for CT Aortic Angiograms was 1180 mGy.cm (n=64). Due to the skewed nature of the dose distribution (figure 2), the median of 1030 mGy.cm was used to represent the typical dose. The median DLP is comparable with the recommended national reference dose of 1040 mGy.cm and is therefore acceptable.

However prompted by this study, we looked at this group of patients in more detail with a view to further reduce doses. This group is typically men between the ages of 60-80 who have an abdominal aortic aneurysm (AAA). The AAA is usually treated by an endovascular stent graft insertion (EVAR) which in turn necessitates further CT scans (up to 3 more CTAs in the first year) for follow-up.

The existing scan protocol involved a pre- and post-contrast helical acquisition covering the abdominal aorta from diaphragm to the groins. Having looked at the protocol, we concluded that the pre-contrast acquisition was only required on the initial study (to show calcification within thrombus) and that the pre-contrast study was not necessary for follow-up examinations. This has therefore been removed from the follow-up protocol. This will save approximately 50 % of the dose for each follow-up scan. An estimated saving of 500 mGy.cm will be made per patient per study. Assuming up to three further CTAs in the first year of follow-up, this represents a cumulative dose reduction of up to 37 % compared with previous practice.

We are also looking at our EVAR follow-up protocol to reduce the number of CT scans (replacing some CTs with duplex USS) in a bid to further reduce the cumulative dose.

Conclusion

By reviewing patient doses for CT studies and subsequently changing the scanning protocol and frequency we have shown that we can reduce patient doses by up to 1500 mGy.cm in one year, a saving of up to 37 % compared with previous practice. A follow-up re-audit in one year is planned to confirm our estimates and re-evaluate practice.

Figure 1: Mean DLP values from the initial patient dose audit

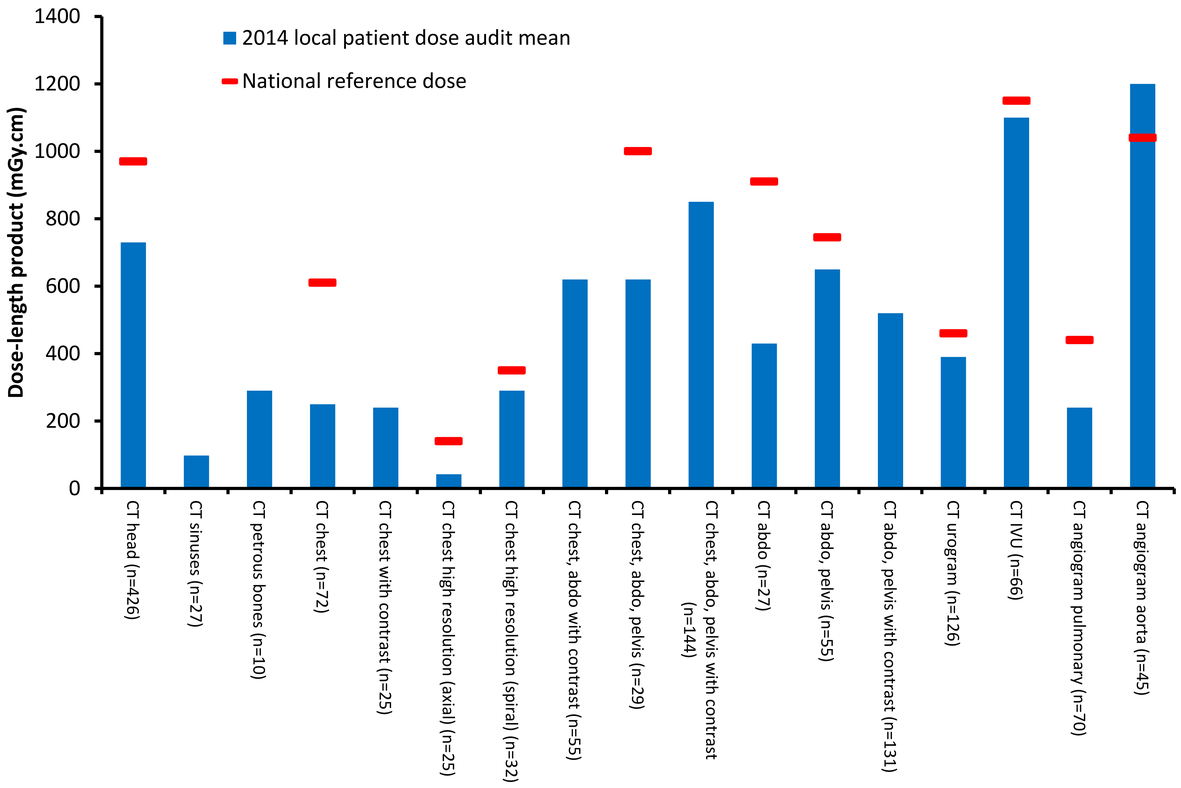
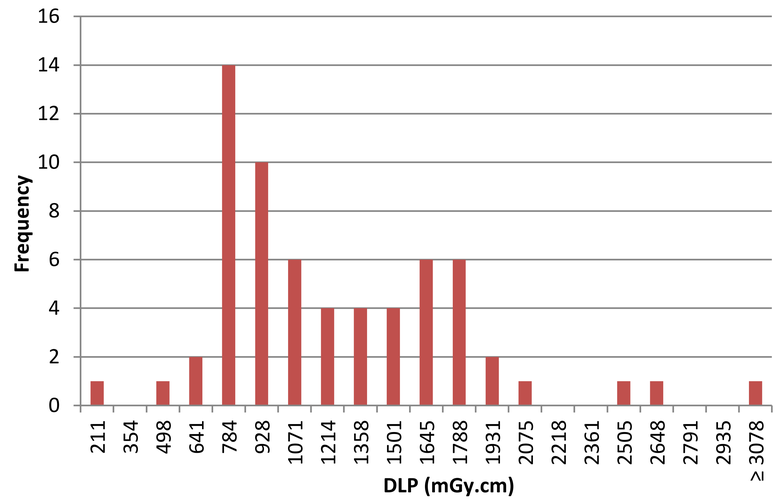


Figure 2: Histogram of DLP from filtered CTAA dataset (n=64)



References

1. "PHE-CRCE 013: Doses from computed tomography (CT) examinations in the UK (2011 review)", Public Health England, September 2014.
2. www.openrem.org