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COMMENTARY

Towards transparency in cardiac radiology: should CT coronary angiography radiation doses be published?

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ABSTRACT

This is a commentary on the use of radiation dose as a quality marker in CT coronary angiography.

Recent national headlines have again brought into focus the quality of medical practice in this country. The Francis report of the public inquiry into the events at Mid Staffordshire NHS Foundation Trust emphasizes the priority of high-quality patient care.¹ For medical practitioners, revalidation has been launched as a means of assessing and demonstrating quality following previous enquiries, but this is very much about ensuring that minimum standards are met: is an individual doctor safe to practice or not? For those who are deemed fit to practice, there need to be ways of demonstrating the quality of practice to show that we are performing to a high level and providing high-quality patient care. Moreover, these results need to be transparent, readily available for all to see in a clearly laid out and concise format online.

LESSONS FROM CARDIAC SURGERY

Following the Bristol inquiry, the need for greater transparency around the quality of medical practice, such as surgical mortality data, became clear.² The Society of Cardiothoracic Surgeons first started publishing unit-specific and surgeon-specific mortality data in 2005, and this has progressed such that >80% of UK cardiac surgical units now contribute data for this audit. The results are published and available online in the public domain.³ Tables are provided for risk-adjusted mortality against the number of operations performed, and patients are able to see how the mortality rate data of their surgeon compares with those of other surgeons across the country (<http://www.scts.org/patients>). Although this is only one marker of outcome and therefore of quality, it is a very important one for the patient. Cardiac surgery is now very much leading the quality agenda with a number of initiatives to put other surgeon-specific markers of quality in the public domain. This process of transparency met with understandable caution and some resistance initially, but it is now accepted as part of the

modern day surgical practice.⁴ More surgical and interventional specialties have followed this lead and have published mortality data during 2013.

QUALITY MARKERS IN RADIOLOGY

The way in which we determine quality in medical practice can be difficult to define. Procedural outcomes such as mortality can be reasonable quality markers in procedural specialties, but determining equivalent quality markers in, for example, diagnostic imaging is more difficult. Peer review, discrepancy meetings and case reviews have been proposed and developed to provide all radiologists with information on the quality of their practice for appraisal and revalidation purposes. The concept of peer review in particular is an excellent way of individually demonstrating that our image interpretation is accurate compared with our peers, although the pressures of modern day hospital practice means that this will be difficult to perform thoroughly and on a regular basis.

CAN WE USE RADIATION DOSE AS A QUALITY MARKER IN CT CORONARY ANGIOGRAPHY?

CT coronary angiography (CTCA) is rapidly becoming established as a useful tool in the assessment of patients with chest pain. Outstanding quality images of the coronary arteries can be obtained, and there are increasing data demonstrating good diagnostic accuracy in comparison with conventional coronary angiography (CA). While some patients have previously proved challenging to image reliably using CT, such as those with calcification of the coronary arteries or dysrhythmia, recent evidence suggests that this is no longer a major impediment with current state-of-the-art scanners.⁵

One of the biggest challenges to CTCA becoming a routine and widely accepted technique has been radiation dose. When first established in clinical practice, the radiation doses

were high, indeed extremely high (approximately 15–30 mSv), and this made it difficult to justify in comparison even with conventional CA (traditionally 3–6 mSv).⁶ Many of the recent advances in CTCA technology have been in developing methods of obtaining diagnostic image quality at a lower radiation dose, including reducing the tube voltage (kVp) from 120 to 100 or even 80 according to the patient's body mass index (BMI), reliability of prospectively gated studies (allowing radiation to be delivered only at a set point in the cardiac cycle rather than continuously), aggressive heart rate control (with cardiac CT practitioners now very familiar with administering oral and intravenous beta-blockers to patients) and different methods of image reconstruction, including iterative reconstruction.⁷ The effect of these dose-saving measures is that it is now feasible to perform CTCA with low radiation doses in the majority of cases and <1 mSv in some patients.⁸

Should we therefore not take the next logical step and accept that the radiation dose is a marker of quality of practice? It is reasonable to presume that cardiac CT units performing CTCA at low radiation doses are using all of the available techniques, which require attention to detail and a tailored examination for each patient. A scan simply performed to one standard protocol is likely to deliver good image quality but is also likely to give the patient a higher radiation dose than necessary. All of this presumes that diagnostic image quality is obtained, as it is of course the imaging practitioner's responsibility to ensure that an answer to the clinical question can be provided. We have to accept that some patients will need a higher radiation dose than others (for reasons including high BMI, heart rate variability and inability to control heart rate). Overall, however, units using all the modern radiation reduction techniques would be likely to give a much lower mean radiation dose and would be likely to be working to high quality.

STARTING ON THE ROAD TO TRANSPARENCY

The British Society of Cardiovascular Imaging (BSCI) is the national special interest group for cardiac CT. Given some preliminary cardiac CT unit radiation dose data suggesting that there is a variation in CTCA radiation doses across the country, the BSCI has started a prospective data collection of radiation doses in CTCA, together with those data that are likely to increase the dose required in a given patient to obtain a diagnostic study. The radiation dose in the form of the dose-length product is being used, owing to ongoing debates as to the nature of the correct conversion factor required to generate an effective dose. Initially, this is being performed among a small number of units to demonstrate proof of concept and to refine data collection, prior to a proposed roll-out among all cardiac CT units across the UK willing to participate. Once complete, this will allow units to benchmark their radiation doses against others in the UK. There would then be no reason not to move to being transparent with these data, making it available for all to see, including patients and purchasers of care, as long as the data collected and presented are an accurate record of unit practice. It is anticipated that this would then result in a trend to lower radiation doses nationally, just as cardiac surgery mortality has

reduced since the publication of mortality rates.⁹ This would then have achieved the objective of creating a quality marker and quality improvement, resulting in better and safer patient care.

THE CHALLENGE OF MOVING TO TRANSPARENCY OF DATA

Although all of this may seem logical, there are potential challenges and difficulties in publishing unit-specific or even radiologist-specific radiation doses. The first is how these data are made interpretable and understandable to patients. There has to be a clear explanation of the theoretical risks of radiation, together with the annual indicative radiation exposure that we all receive from the environment to help put these radiation dose data into context. Although we know all this as radiologists, the public is becoming increasingly aware of the risks of radiation and the effects of increasing radiation exposure from medical procedures and investigations.

The objective must be to provide high-quality care to all patients and not to create an environment where only simple cases that can be performed at low radiation dose are undertaken to maintain a low overall unit radiation dose. With more data, there has to be stratification by complexity of case (in the same way as cardiac surgeons present risk-adjusted mortality data) to ensure that more complex patients requiring a higher radiation dose for a diagnostic study are not denied a scan. Although these more complex cases may require more radiation, there are still dose-saving methods that can be employed, and useful comparisons can be made on these cases between individual centres.

The next challenge is the impact on units that have a higher radiation dose than average. It may be that a unit is using older equipment than others owing to difficulties in funding updated modern CT scanning equipment. It is possible that these data could then be used locally as strong evidence for the need for purchasing an up-to-date scanner. Some of the dose reduction techniques can be used on some of the less state-of-the-art scanners, but it is likely that the need for investment in a current range of CT scanners with the necessary software would become compelling. If a unit is found to have high radiation doses despite having the latest scanner technology, it is likely that that individual unit would respond by addressing their practice, learning from other centres and learning from the scanner manufacturers as to how doses could be lowered while maintaining diagnostic image quality.

CONCLUSION

The biggest challenge of all is the change in our mindset. There is no reason why accurate, properly presented radiation dose data should not be made available to the public on a professional society website. We can be transparent with these data, which are already collected, to demonstrate that we are providing a high-quality service that is anchored in patient safety. Whether the same can apply to CT of other parts of the body remains to be seen. For now, while radiation dose is not the panacea of quality in CTCA, it seems like the right place to start.

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