

IMAGING THE DEAD

Could a routine radiological autopsy service ever be introduced in the UK? **Geoff Watts** investigates

Derived from the Greek for “self” and “eye” the word autopsy means to see for yourself. In the context of a body, and whether the viewing is for forensic or other purposes, seeing for yourself has meant cutting and slicing to examine the internal organs. But relatives dislike such intrusion, and some religions, especially Islam and Judaism, discourage it. So why do we still do it when recent decades have witnessed the advent and development of scanning technologies that can give us the same information non-invasively?

The short answer is that they can't. More precisely, they can't tell us everything we need to know in every case. But can they tell us enough, and sufficiently often, to justify their routine use? The preliminary results of a couple of pilot studies commissioned by the Department of Health have begun to provide tentative answers.

Some half a million deaths are registered annually in England and Wales. In 2009, 46% were referred to coroners, and 46% of these bodies had a postmortem examination. This figure is much higher than in most countries. Indeed, in the view of some commentators, it is too high. Speaking at a recent Royal Society of Medicine conference on the use of postmortem imaging, the medical secretary of the Coroners' Society of England and Wales, Roy Palmer, wondered if we could safely

reduce our invasive autopsy rate nearer to those found in comparable countries—in the United States, for example, the figure is more like 8%—and whether imaging techniques might help to achieve this goal.

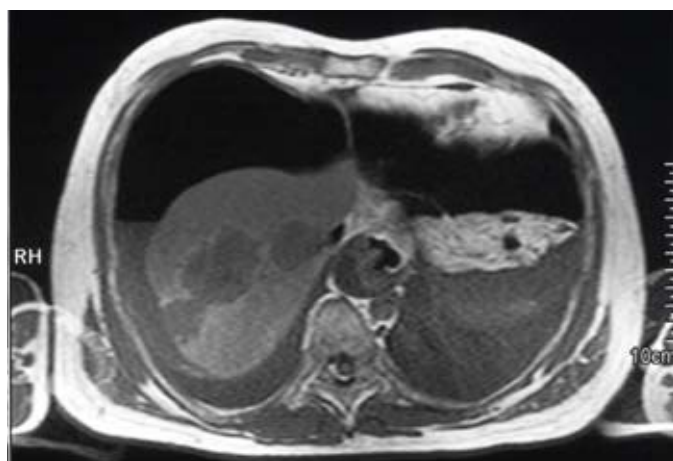
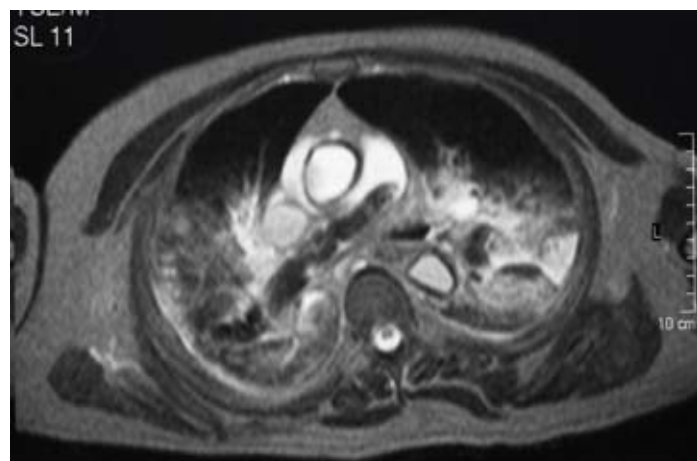
One compelling argument for a general reconsideration of the present autopsy arrangements is their less than impressive accuracy. A 2006 report by the National Confidential Enquiry into Patient Outcome and Death found that one in four autopsy reports was poor or unacceptable, that the brains of one in seven corpses were not examined, and that in nearly a fifth of cases the stated cause of death appeared questionable.¹ Another speaker at the royal society meeting, radiologist Stephen Lee of Manchester University, commented that there are circumstances in which scanning can pick up changes that are easily missed on physical examination. He illustrated the point with a magnetic resonance image of a small infarct: clear enough on the scan; tricky to spot by eye.

Virtual examination

Autopsy by magnetic resonance imaging (MRI) or computed tomography (CT) is exceptional but not new. It has been in use for a decade, mainly at the behest of relatives who object on religious² or cultural grounds to conventional autopsy, who

have persuaded the local coroner to accept this approach, and who are prepared to pay the cost of around £1000 (£1200; \$1600). Dr Lee is one of a small number of radiologists with experience in this field. Following requests from local Muslims and Jews, he and his colleagues began to perform MRI autopsies in 1997. Since that time they've done around 250 on people who died aged from 18 to 94. The mix of causes of death was fairly typical, and in only 14 cases were they unable to reach a conclusion. In two of these the cause remained uncertain even after a physical examination. In Dr Lee's experience MRI is not suitable in cases of drowning, after a prolonged period in intensive care, or when there has been severe gastrointestinal bleeding or extensive decomposition. Coronary arterial disease and pulmonary embolism can also create difficulties.

Manchester coroner Nigel Meadows has taken a close interest in the progress of virtual autopsy in the area. He considers each application on its merits and retains the right to order a subsequent physical examination. His broad conclusion is that although radiological scanning is not suitable in every case, it does offer another tool in the box. His views chime with those of Dr Palmer, who insists that the desires of relatives, politicians, and others who may be keen to see this approach used more widely must not be allowed



In which circumstances can the scanner now safely replace the scalpel?

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to over-ride the need for trustworthy data. Scanning is non-destructive, creates a permanent record of the evidence, offers images that have grown progressively sharper and more revealing, and even creates possibilities such as virtual dissection. But doctors and coroners alike will be concerned if autopsy by imaging goes ahead in the absence of evidence of its true reliability in diagnosing cause of death.

Early promise

Given the stack of doubts and uncertainties about radiological autopsy it was wise of the Department of Health to commission a couple of studies—one in adults, the other in infants and fetuses—to assess its accuracy and practicality. The principal investigator of the adult study is Ian Roberts, now a consultant pathologist at John Radcliffe Hospital, Oxford, but formerly working in Manchester. His research has covered 250 deaths, 209 of which were used for an independent comparison of postmortem CT, MRI, and CT plus MRI with full autopsy. At the royal society meeting Dr Roberts presented an analysis of the first 158 cases. This showed that the rates of discrepancy in reported cause of death between full autopsy and CT, MRI, and CT plus MRI were 33%, 44%, and 30%, respectively. Independent reports by two radiologists interpreting the CT and MRI scans showed major differences in the cause of death in 44% and 51% of cases, respectively. Radiologists' confidence in their conclusions rose as they gained experience, but their accuracy did not. The most frequent errors were in the diagnosis of coronary heart disease and pulmonary emboli and in distinguishing pulmonary oedema from pneumonia.

The Manchester group also devised a novel method of minimally invasive CT coronary angiography that they carried out before a conventional autopsy in 10 cases. Their preliminary results suggest that when combined with a scan its findings on coronary pathology correlate well with those of a full autopsy.

Andrew Taylor, professor of cardiovascular imaging at University College London, is running the paediatric study. The aim in this case is to compare MRI and CT scanning with conventional autopsy in 600 fetuses, neonates, and infants. An intermediate analysis of the first 200 scans, predominantly fetal, is encouraging. "In a majority of the fetal cases—in the high 90s as a percentage—I would say we can identify brain and spinal causes of death." This is valuable because it avoids the need to open the skull—something that is important to parents. Scanning also scores well in look-

ing for congenital abnormalities in fetal hearts and lungs. With neonatal cases the lungs tend to be a problem because changes induced by some of the more frequent disorders such as pneumonia resemble those that occur anyway after death.

"At the moment we see the technique as something that can be offered to parents as a first step," says Professor Taylor. "What we don't know is in how many cases we can be completely correct without having to take some sort of tissue sample." Once the full analysis is completed he hopes to be able to identify a group in which he can say with certainty that non-invasive examination will be sufficient.

Practical problems

Many issues remain to be resolved. Should the scanning be by CT or MRI, for example? Professor Taylor favours MRI. "Most of what we want to know depends on tissue characterisation, and MRI is better. CT just doesn't give you the contrast and definition you need. But things seem to be different in the adult group." Indeed, in Dr Roberts's study it was CT that gave better results. There are also several practical considerations; CT is cheaper, quicker to perform, and more widely available.

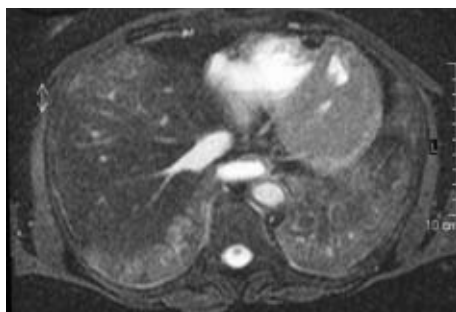
So where does this leave us? Dr Lee emphasises the importance of discussions between coroner, pathologist, radiologist, and relatives when deciding whether to scan. But could a routine and widespread radiological autopsy service be introduced now? From his reading of the literature, forensic pathologist Guy Rutt of Leicester Royal Infirmary believes it couldn't. Mindful of, among other things, the current lack of supporting infrastructure, trained radiologists, training programmes, and protocols his conclusion is one that few would dispute. On the other hand, he adds, there is nothing in law to prevent its future development and some evidence to suggest that both the public and the medical profession would be content to see this happening.

On the basis of their findings, Dr Roberts and his colleagues can envisage minimally invasive autopsy being used in a three stage process. The first step would be to review the deceased's clinical history and the circumstances of his or her death, then do an external examination and a

whole body scan together with other investigations as required. If this did not give a definite cause of death, the next step would be to perform CT coronary angiography. When doubts still remained, the third step would be a full autopsy.

Such a protocol, he says, would reduce the number of invasive autopsies required and also improve their quality.

The closing speaker at the royal society meeting was Erika Denton, the Department of Health's national clinical lead



Mixed signal myocardial infarction in left ventricle

for diagnostic imaging. As such she (or some future successor) will have a key role in formulating any plans the department makes to introduce a systematic radiological autopsy service. Her current view is that work so far completed has already shown a role for imaging. But she is conscious of the hurdles. These include cost (a conventional autopsy is priced at a little under £100, although this disguises a substantial subsidy from general hospital funds), the limited number of radiologists able to use CT and MRI for forensic purposes; and the need for training programmes and agreed guidelines. At present, when individual radiologists are asked to carry out a virtual autopsy, the department is hard pressed to know what to advise them. What it wouldn't wish to see is an increasingly ad hoc provision of services followed by the familiar cry of postcode lottery.

In a statement the Royal College of Pathologists declared that "modern imaging techniques should complement, rather than compete with or replace, conventional approaches to investigating the cause of death." This emollient view seems to be a fair reflection of generally held attitudes. As Dr Roberts is keen to emphasise, the debate is not "for" or "against" the use of imaging technology but about the circumstances in which the scanner could now safely replace the scalpel.

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- 1 National Confidential Enquiry into Patient Outcome and Death. The coroner's autopsy: do we deserve better? NCEPOD, 2006.
- 2 Saad Foundation. MRI PM vs PM. http://saadfoundation.com/index.php?option=com_content&view=article&id=3&Itemid=3.

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CHRISTOPHER FURLONG/GETTY IMAGES



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Is the UK turning the clock back on public health advances?

With the white paper on public health due out any day now, **Jacqui Wise** asks whether the coalition government's anti-regulation, pro-industry approach is ill judged

The coalition government in the UK stands accused of allowing the food and drink industry to dictate public health policy. This follows the revelation that the newly formed committees charged with "creating a new vision for public health" are packed with industry representatives from companies such as McDonald's, PepsiCo, and Kellogg's.

A number of other moves which might concern those in public health have been made. Since coming to power in May the government has dropped the traffic light food labelling scheme, rejected minimum pricing of alcohol, and refused to honour the Labour government's pledge to extend free school meals to all children living below the poverty line. The coalition has also suggested that it may overturn the ban on cigarette vending machines and point of sale advertising of tobacco, which was due to come into force starting next year.

Many of the announcements made by health secretary Andrew Lansley have been positively received. He has announced there will be a new Public Health Service with a ringfenced budget. In addition there will be a cabinet subcommittee on public health. The role of local government in improving public health will be strengthened.

But aside from the rhetoric the signals coming out of Whitehall do not look good to some doctors. The recent "bonfire of the quangos" led to the loss of the Health Protection Agency, the independent body giving advice on public health matters. The Food Standards Agency

has been radically reorganised so that it is a shadow of its former self, having lost responsibility for nutritional policy and food labelling.

The FSA led calls for the Europe-wide introduction of a traffic light system that required food companies to label their products with red, amber, or green symbols to denote the amounts of fat, saturated fat, salt, and sugar contained per serving. This was buried by the European parliament when MEPs backed a rival system of guideline daily amounts favoured by industry. The food industry had lobbied intensively against the scheme sparking accusations that the government had "caved in to big business."

Professor Lindsey Davies, president of the UK Faculty of Public Health, said: "I am very disappointed about the food labelling decision. I know there were EU considerations but countries can be brave about such issues. I think it is surprising as this government says they are all about making choices easier for individuals."

Professor Martin McKee, professor of European Public Health at the London School of Hygiene and Tropical Medicine, added: "The evidence on food labelling is unequivocal. A



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PUBLIC HEALTH INITIATIVES AXED OR UNDER THREAT

- Free school meals—currently available only for families receiving unemployment benefit. The coalition government has said it will not honour the planned extension of the scheme to all families below the poverty line, which is calculated at £19 500 a year for a couple with two children
- Free swimming—the scheme for the under-16s and over-60s was launched by the Labour government two years ago as a London 2012 Olympic legacy initiative. But the Sports and Olympics minister, Hugh Robertson, said that the scheme was “a luxury” that could no longer be afforded
- All ringfenced funding for school sport is to be cut
- Speed cameras—the government has stated it will not fund any more new fixed site speed cameras. It has also announced a 37% reduction in the road safety support grant funding provided to local authorities for road safety purposes
- Traffic light labelling of food—will not now go ahead after the European parliament backed industry’s preferred option of guideline daily amounts
- Minimum pricing of alcohol—recommended by NICE, the Royal College of Physicians, and others, but rejected by the coalition government (as it was under Labour)
- Point of sale advertising of tobacco—the coalition has suggested the forthcoming ban may be overturned

failure to introduce a traffic light scheme is the clearest possible indication that the food industry is in the driving seat.”

The coalition government has also axed the marketing budget for Change4Life, the healthy living campaign, calling on the food and drink industry to fund it instead. Lansley said in July: “We have to make Change4Life less a government campaign, more a social movement. Less paid for by government, more backed by business.”

The government has said it wants to work with business to draw up new “responsibility deals” based on social responsibility not state regulation. The aim is to create a new vision for public health where all of society works together to get healthy and live longer. Further details of how this will be achieved and the remit of these responsibility deals are not yet known but are due to be published in the forthcoming white paper.

What is known is that of the 24 members of the overarching public health responsibility deal, more than half are from industry (see box, p 1134). These include representatives from the five biggest supermarkets, Unilever (manufacturer of Pot Noodles and

Walls ice cream), the Wine and Spirits Trade Association, the Food and Drink Federation, the British Hospitality Association, and Diageo (spirit and beer producer).

Under this main public health deal there are five networks covering food, alcohol, health at work, physical activity, and behaviour change. Two of the five chairs are from industry—Jeremy Beadles, chief executive of the Wine and Spirits Trade Association, is to chair the alcohol network and chairing the Physical Activity Network is Fred Turok from the Fitness Industry Association.

The Department of Health refused to give out the full list of members of the five networks, but according to the *Guardian* it includes fast food companies McDonalds and KFC and processed food and drink manufacturers such as PepsiCo, Kellogg’s, and Mars. All a spokesperson would say was: “For the forthcoming Public Health White Paper we’ve engaged a wide range of people, to help us develop the Responsibility Deal drawn from business, the voluntary sector, other non-governmental organisations, local government, as well as public health bodies. The Deal needs to result in practical changes which help people make

healthier choices about what they eat and drink and how to become more active. Change is needed from national level right down to grass roots.”

Professor Andy Haines, former director of the London School of Hygiene and Tropical Medicine, said: “There is a good case for consulting with the private sector but they have obvious conflicts of interest. It seems to me that the balance on these committees is too far in favour of industry.”

Vivienne Nathanson, head of BMA science and ethics, agrees: “I worry that policy seems to be being led by industry not the other way round. It would be difficult to make joined up policy in this way.” She adds: “We know that the tobacco industry was very successful in slowing down legislation on tobacco and we worry that the food industry may slow down effective policies in the same way. Does the government make policy on the basis of good scientific evidence or on the terms of what is feasible or easy for industry?”

The Faculty of Public Health, which has called for a ban on trans fats in food, minimum alcohol pricing, and a ban on junk food advertising in pre-watershed television, is represented



“We had concerns but . . . I think there must be a conversation between industry and the profession”
Professor Lindsey Davies



SARAH TURTON/BMA NEWS

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“A failure to introduce a traffic light scheme is the clearest indication that the food industry is in the driving seat”
Professor Martin McKee

on many of the Responsibility Deal groups. Professor Davies said: “We had a long and hard discussion about joining. Of course we had concerns about it but the overall view was that it was important that our voice was heard and to give it a go. I think there has to be a conversation between industry and the profession.”

Dr Alan Maryon-Davies, honorary director of public health at King’s College, London, is on the physical activity network. “It’s early days yet and there is all to play for. It is up to the public health people to engage with the discussions

and get the best out of it. But I would like the deliberations to be open and transparent and minutes to be publicly available if possible.”

Another concern of public health doctors is that the coalition may overturn the ban on cigarette vending machines and point of sales advertising passed in the last few months of the Labour government. The Tobacco Act requires supermarkets to get rid of point of sale displays by late 2011 and newsagents by October 2013. Those who manufacture and sell tobacco products have lobbied hard against this law. The

coalition has suggested it may overturn the ban saying in a parliamentary question earlier this year that it would give further consideration to the policy because of the challenges facing “business competition and costs.” Cigarette manufacturers have also threatened to seek a judicial review of the ban. However, the government is said to be considering forcing tobacco companies to package their cigarettes in plain brown wrappers in a move that has been welcomed by health campaigners.

The BMA has called for government to commit to banning tobacco displays in shops after research published this week in the journal *Tobacco Control* shows that similar legislation in Ireland has not harmed business and has helped young people to quit smoking.¹ Dr Nathanson said: “This will be an important marker of the government’s intentions on public health. It will be a line in the sand. It will be very worrying if they don’t go ahead with this.”

Lansley’s approach is one of individual engagement and responsibility. He has said he wants to move away from “lecturing or nannying,” instead “nudging individuals in the right direction.” Dr Maryon-Davies comments: “The whole anti-regulatory or ‘light touch’ regulatory approach does bother me. I know from bitter experience that voluntary agreements don’t really work unless they are backed by the threat of regulation. One example was in salt reduction.”

And Dr Maryon-Davies again: “One general concern with the white paper is that a lot of change is going through at the same time as a lot of cuts are happening. It is going to be a real challenge. In a recession people rely even more on props such as smoking and cheap food. It is important to make the healthy choices the easy choices.”

Much of the forthcoming white paper on public health is expected to focus on the organisation of the new public health service and detail how local authorities will work to improve public health. However, it should also give an indication as to what the government’s intentions are regarding the balance between regulation and personal responsibility. As always the devil will be in the detail.

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1 Quinn C, Lewis S, Edwards R, McNeill A. Economic evaluation of the removal of tobacco promotional displays in Ireland. *Tobacco Control* 2010; doi:10.1136/tc.2010.039602.

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MEMBERS OF THE PUBLIC HEALTH RESPONSIBILITY DEAL—OVER-RIDING BODY

Andrew Lansley, health secretary
 Paul Burstow MP, care services minister
 Anne Milton MP, public health minister
 Cancer Research UK
 British Retail Consortium
 Dame Carol Black, national director for health and work, Department for Work and Pensions
 The Co-operative
 Tesco
 Diabetes UK
 Sainsbury’s
 Fitness Industry Association
 Unilever UK & Ireland
 Which?
 Compass Group
 Wine and Spirits Trade Association
 Local Government Association
 Lindsey Davies, president, Faculty of Public Health
 Food and Drink Federation
 ASDA

National Heart Forum
 Morrison’s Supermarket plc
 Susan Jebb, head of nutrition and health research, Medical Research Council
 Advertising Association
 British Hospitality Association
 Diageo GB
 Yvonne Doyle, regional director of public health, South East Coast SHA

The chairs of each of the five networks

Food network—Susan Jebb, Medical Research Council
 Alcohol network—Jeremy Beadles, Wine and Spirits Trade Association
 Health at Work network—Dame Carol Black, National Director for Health and Work
 Physical Activity network—Fred Turok, Fitness Industry Association
 Behaviour Change network—Paul Lincoln, National Heart Forum