Could pre-mortem computerised tomography scans reduce the need for coroner's post-mortem examinations?

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ABSTRACT

INTRODUCTION Post-mortem examinations may result in considerable distress to the bereaved family. This audit was undertaken to examine whether computerised tomography (CT) scanning prior to death might reduce the need for post-mortems without compromising the accuracy of recording the cause of death.

SUBJECTS AND METHODS The case notes of 100 consecutive patients who had a coroner's post-mortem, because the cause of death was unknown, were reviewed by four senior clinicians. Along with the likely cause of death, the clinicians gave their opinion as to whether a CT scan would have enabled certification of death without the need for a post-mortem. Concordance between the post-mortem findings and the clinical events surrounding death was explored.

RESULTS It would have been possible to perform a pre-mortem CT scan on 90 of the 100 patients. A pre-mortem CT scan would have given the cause of death in 59 (66%) of these. In 30 patients, the cause of death established by the post-mortem was at variance with the clinical events surrounding death and clinically relevant information, such as recent surgery, was not recorded on the death certificates of 26 patients.

CONCLUSIONS The use of a pre-mortem CT scan and involvement of senior clinicians in the process of establishing cause of death will improve the accuracy and may obviate the need for a post-mortem in some patients. However, if a post-mortem is needed, the clinical notes should always be available for the pathologists and a senior member of the patient's team should attend the post-mortem to help accurate death certification.

KEYWORDS

Pre-mortem – CT – Post-mortem examination – Pre-mortem investigations – Computerised tomography – Autopsy

Accepted 17 December 2009; online publication 9 April 2010

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Post-mortem examinations result in considerable additional distress to the bereaved family. Any intervention that might reduce the need for a post-mortem would, therefore, be welcome, provided accuracy in recording causes of death was not compromised. One such intervention is computerised tomography (CT). The use of diagnostic imaging in patients to reduce the need for post-mortem when the cause of death is unknown was suggested as long ago as 1975.¹

There is a dilemma with the concept of 'pre-mortem' investigation. Conventionally, and correctly, the accepted view has been that investigations of any type can only be justified if there is a possibility they will alter patient management. In practice, this is rarely the case in those nearing death. In many such cases, patients deteriorate and die with

an unknown or uncertain diagnosis and a post-mortem is carried out. An alternative approach might be to request a CT scan regardless of its benefit to clinical management. This might, in some cases, permit confirmation of a diagnosis before death thereby obviating the need for a post-mortem.

This study was conducted to determine whether pre-mortem CT scanning might reduce the need for post-mortem examination.

Subjects and Methods

A retrospective case-note review was carried out for a consecutive series of 100 patients who had a coroner's post-

mortem, because attending clinicians were uncertain as to the cause of death or reticent to complete death certification. This audit was approved by our audit department and by the local coroner. The coroner's office provided the details for the patients studied, including the causes of death reported after the post-mortem examination.

Patients' case notes were reviewed by four senior consultants, a surgeon, a physician, an intensivist and a radiologist who were 'blinded' to the recorded cause of death determined after post-mortem. The clinicians gave their opinion as to the cause of death based on the clinical information available at the time of death (*i.e.* before post-mortem). The post-mortem result was then revealed to the clinicians, who were asked to comment whether a pre-mortem CT would have established the findings of the post-mortem. They were also asked whether the given cause of death was in accordance with the clinical scenario.

Results

This audit comprised 100 patients. The median age was 79 years (range, 19–96 years) and 51% were males. The median duration of hospital stay was 4 days (range, 0–61 days). The median waiting time before a post-mortem was carried

Table 1 Details of the causes of death as established by the post-mortem examination

Cardiovascular	
Myocardial infarction	12
Myocardial fibrosis/CAD	15
Ruptured aneurysm	3
Other cardiac	4
Total	34
Respiratory	
Pneumonia	18
Pulmonary embolus	7
Pulmonary haemorrhage	3
Lung cancer	2
Lung other	5
Total	35
Gastrointestinal	
Ischaemic bowel	4
Visceral perforation	13
Bowel obstruction	4
GI bleed	5
GI cancer	3
Other GI	2
Total	31

Table 2 Details of pertinent clinical information missing from death certificates written after post-mortem

Missing clinical information	Number of cases (patients)
Recent orthopaedic procedure	17
Recent vascular procedure	3
Recent other surgical procedure	2
Advanced cancer	2
Established relevant co-morbidity	2

out was 3 days (range, 0–9 days). Fifty-five cases were medical, 20 orthopaedic patients and the remaining 25 in other surgical specialities.

In 10 cases, the death was sudden and unexpected, with insufficient time to request a pre-mortem CT. In the remaining 90 patients, a CT scan would have shown the cause of death as revealed in the post-mortem in 59 patients (66%).

Table 1 provides a break-down of the causes of death as established by the post-mortem examination. In 30 patients, the cause of death provided by the pathologist was at variance with the clinical scenario. In 15 of these, myocardial fibrosis or coronary artery disease alone was recorded as the primary cause of death despite there having been no evidence of cardiac problems pre-mortem. In three patients who underwent cardiopulmonary resuscitation, pulmonary haemorrhage was recorded as the primary cause of death. Relevant clinical information, such as recent surgery, known malignancy or established co-morbidity was missing on the death certificates of 26 patients (see Table 2 for details). Cerebrovascular disease was not recorded in any of the 100 patients in this series.

Clinicians felt that sufficient clinical information was available to issue a death certificate in 38 cases without the need for a post-mortem examination. Of these 38, the cause of death suggested by the clinicians from reviewing the clinical notes agreed with that subsequently identified at post-mortem in 24 cases (63%).

Discussion

The need for a coroner's post-mortem may delay funeral arrangements and add to the emotional and psychological stress of bereavement. Although the majority of post-mortem examinations in this series were conducted within 3 days, in some cases families had to wait up to 9 days before they were provided with death certification. Any intervention that might facilitate prompt and accurate issuing of death certificates, and reduce pressure on pathology

services is to be welcomed. Data from this study suggest that a thorough review of the notes by a senior clinician (involved in the patient's care) may be sufficient to issue a death certificate without the need for a post-mortem. However, it should be noted that the proposed cause of death did not agree with the post-mortem findings in a third of cases. The use of a pre-mortem CT scan may, therefore, provide a useful adjunct to increase the accuracy of this process.

Pre-mortem CT scan would be reasonably expected to identify this cause of death provided by the post-mortem examination in around 66% of cases. Although the sensitivity of pre-mortem CT scans for providing a cause of death is somewhat disappointing, it is unlikely that these scans will provide a misleading cause of death. It is, therefore, conceivable that pre-mortem CT scans might obviate the need to a post-mortem in a substantial number of patients.

We recognise that it would be inappropriate to seek consent from patients or their relatives for a pre-mortem CT simply on the basis this might obviate the need for a post-mortem. This would be unacceptably callous and unsympathetic. However, if imaging is being considered for diagnostic purposes, the possibility that this might facilitate accurate death certification should be considered. Establishing a firm diagnosis in this way may help the family and the patient come to terms with the illness, plan for death and may also help clinicians to control patient's symptoms.

The concept of a 'pre-mortem' CT is not without precedent. CT scans as well as other imaging modalities are being increasingly used in the field of forensic pathology.^{2,3} However, the quality of these scans is inferior when they are conducted on the deceased compared to the living,

mainly because the lack of intravenous contrast results in an inability to identify vascular abnormalities and to assess tissue perfusion. A further benefit of using imaging in establishing cause of death is its reproducibility and the generation of a permanent objective record.

This audit has also shown that, in a third of cases, the post-mortem findings were at variance with information in the clinical notes. In our institution, doctors responsible for the patient's care rarely attend post-mortem examinations and the pathologist does not have routine access to the clinical notes. The only clinical information made available is that provided to the coroner's office by the referring doctor. In many cases, these referrals are made by the most junior member of the team and important information may be lacking. We would suggest that the clinical notes should always be available for the pathologists and that a senior member of the patient's team attend the post-mortem. This will help to ensure that the post-mortem examination provides the most accurate and comprehensive information regarding the cause of death.

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