3. Results of study

Internal examination

The internal examination is the description of each organ system inside the body (the skin, the largest organ of the body, is generally described as part of the external examination). When traumatic injuries are not relevant to the cause of death, it is the results of these internal organ inspections that indicate the pathological processes that have happened.

The assessment results and discussion of the internal examinations are presented here in five distinct categories:

- Internal examination of major organ systems;
- When to open the skull and examine the brain;
- Organ weights;
- Overall gross description of the internal organs;
- Decomposed bodies.

Internal examination of major organ systems

Most reports included a description of the findings from the internal examination of each organ system, and generally, the assessments of the internal examinations were deemed good or satisfactory. Figure 9 shows the assessments that were given for each case by the advisors according to each organ system. As expected, the cardiovascular system was generally well examined.

The amount of detail included for organ examinations depends, as well as on the case and on the pathologist, on the nature of the organs themselves. Some are more important than others. The RCPath guidelines specify what should go into reports as best practice[3]. Most persons do not die from endocrine disease or from diseases of the lymph nodes, spleen and bone marrow (lymphoreticular system), and it is reasonable, or at least understandable, that these systems are summarised as 'normal' in most cases. Conversely, cardiac, pulmonary and skeletal diseases are more important, particularly in deaths in the community which comprise the main part of coronial autopsy practice. From Table 15, it is evident that 40% of cases have no useful examination and description of the musculo-skeletal system. This may form the presumption that the musculo-skeletal system is normal until stated otherwise and that injuries and fracture would be noted if present. It is also notable that Schedule 2 of the Coroners Rules does not list the musculo-skeletal system to be described under internal examination requirements, but places it as part of the external examination. It would be sensible simply to state that an organ system is not examined, otherwise the default appears to be that the organ is normal.

Figure 9: Assessment of the internal examination by organ system

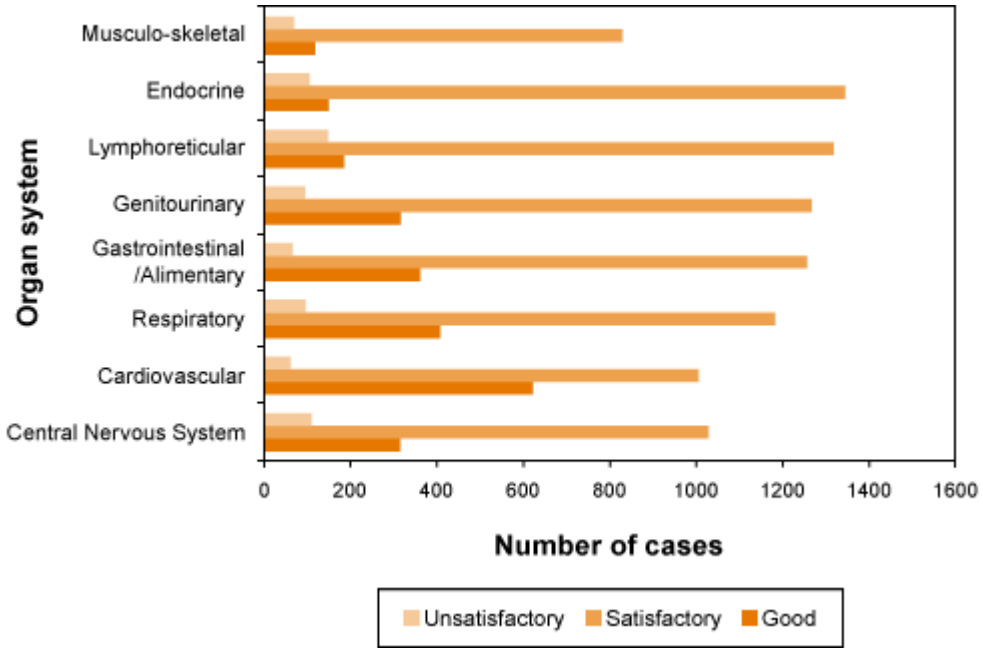


Table 15 lists the number and percentage of organs systems that were not examined.

Table 15: Organ systems not internally examined (answers may be multiple *n=1691*)		
	n=	**%**
Central nervous system	238	14
Cardiovascular	3	<1
Respiratory	5	<1
Gastrointestinal / Alimentary	8	<1
Genitourinary	14	<1
Lymphoreticular	41	2
Endocrine	92	5
Musculo-skeletal	674	40

When examining the musculo-skeletal system, there is usually a trade-off between the amount of information gained and the subsequent disfigurement that will require restitution during reconstruction of the body. A similar situation pertains when examining potential external bruises. In most cases, from knowledge of the circumstances of the death, a detailed examination of the musculo-skeletal system would be quite unnecessary. A different situation arises, however, regarding non-examination of the brain.

When to open the skull and examine the brain?

In 14% (238/1,691) of cases the brain was not examined. On further scrutiny, it was identified that in only five of these cases was there a request from the coroner not to open the head

(implicit in a request noted in the supporting documentation for the autopsy to be limited to the thoracic and abdominal cavities). In these cases, the advisors considered that the pathologist should make a note in the autopsy report indicating that such a request had been made by the coroner.

Not examining the brain was cited by the advisors as either the reason, or one of the reasons, that the report was assessed overall as being poor or unacceptable in at least 5% (83/1,691) of cases (where the advisors had made a specific note concerning this as free text additions).

In the 1995 NCEPOD report[11], the proportion of cases where the brain was not examined was 7%. This study demonstrated a doubling of this figure, although with a very clearly different sample (previous study was perioperative cases only). When this result was stratified with whether or not the death occurred in the community or in a hospital, it was found that approximately 80% of cases, where the brain was not examined, were deaths in the community.

In the RCPath guidelines "it is stressed that...the brain should be examined in all postmortems authorised by a coroner or procurator fiscal"[3]. There are exceptional circumstances where non-examination of the brain might be acceptable if: a) the pathologist, with full clinical information available is confident that no significant pathology will be found, and b) it is perceived that brain removal will cause significant distress to the family, to little diagnostic advantage. An example of this would be a patient treated for lymphoma, having tumour lesions over the now bald scalp, and who was conscious and mentally normal until shortly before dying; where reconstructing the scalp would be technically and cosmetically difficult, and the likelihood of identifying useful pathology minimal.

Nowhere is it stated, but from discussion and personal experience pathologists know that some coroners encourage the non-examination of the head where a cause of death elsewhere in the body is evident. The reasons quoted usually relate to known or anticipated expectations of the family. Some coroners routinely ask the family, when discussing the autopsy that is about to take place, to what extent they might wish to limit the extent of examination, or are they content with a full autopsy examination. This information comes from the coroner advisors and members of the expert group.

Non-examination is particularly concerning in relation to deaths in the community, where in many cases there is no description of the events leading up to death, and where head injury (from self-accident or possibly third party involvement) must be a constant consideration (case study 6). In patients who die under hospital care from hypoxic brain damage secondary to drug overdose, as a consequence of medical/surgical intervention or natural disease processes, the brain is not always examined at autopsy. This was seen in the present study and was also noted in a previous NCEPOD study[12]. The criteria for diagnosing brain death in the hospital situation are clinical and radiological and, interestingly, have never included pathological confirmation. There are, to NCEPOD's knowledge, no published reports of clinical hypoxic brain death that are refuted by subsequent autopsy histopathology.

Case study 6

A young adult was found collapsed in the street having suffered a suspected cardiorespiratory arrest. On admission the pupils were fixed and dilated, a standard indication of a non-functioning brain and was thought to be suffering with hypoxic brain damage. Death occurred after three days on the ICU.

Toxicological analysis showed toxic levels in the blood of co-proxamol, aspirin and ethanol - which were the cause of death. The brain was not examined at all, grossly or histopathologically. Although it is totally reasonable that the drugs caused cessation of respiration and this led to irreversible hypoxic damage to the brain, the advisors felt this should have been examined to exclude any unexpected pathology related to a death in the community.

There could be a 'sliding scale' approach with the degree of certainty over a prime extracranial cause of death in determining whether or not to open the head. For example, ruptured abdominal aortic aneurysm, dissection of the aorta, or definite acute ischaemic heart disease (diagnosed by the Davies criteria[3]) could be diagnosed without examining the brain (in the context of an appropriate clinical history, witnessed absence of violence or trauma, and absence of observed significant/acute intracranial disease). In these cases, the examination of the brain and its coverings is unlikely to reveal pathology germane to the death. It is notable, conversely, that examination of the brain is listed as part of the autopsy examination under Schedule 2 of the Coroners Rules 1984.

Case study 7 raises the question of even more limited examinations, where not only was the head not opened, but other potentially significant organs were not examined either.

Case study 7

The deceased had a past medical history of a myocardial infarction in 1983, cirrhosis of the liver in 2002 and portal hypertension. There was a request from the coroner's officer "Limited PM if possible".

The autopsy report was half a side of A4 and synoptic. It noted no significant marks of violence. The heart showed "ischaemic myocardium otherwise unremarkable. Valves unremarkable. Coronary arteries showed triple vessel atherosclerosis". There were no pulmonary emboli, the larynx was clear and the trachea and bronchi congested. The lungs showed pulmonary oedema. No other organs were examined and there was no clinicopathological correlation. The cause of death was given as:

1a. Coronary artery disease

The advisor noted "This case raises the general issue of requests for a limited PM. Should such requests be made? Should a pathologist (who is asked to give the cause of death) agree to be limited in what he/she does?"

The case also raised the question as to what the phrase "ischaemic myocardium" actually means; does it mean acute ischaemic necrosis (acute infarction) or scarring from old infarction or perhaps non-specifically pale? The non-specific term was used several times

across the sample of autopsy reports, without further qualification.

From discussion amongst the advisors, this is the area where there was significant lack of consensus. Reflecting on what was found in the study, some of the pathologist advisors said that they did not always open the head if the case did not fulfil requirements to do so (examples as discussed above). Others stated that without exception they always opened the head. The coroner advisors were similarly disparate and one indicated that their default position was to ask the pathologist not to open the head unless the pathologist considered it necessary.

This is a difficult area indeed. As with many other aspects of coronial autopsy practice, there needs to be wider discussion amongst all the interested parties and an agreed standard of practice (see 'Overview and discussion' section). However the basic recommendation is that the head should be opened in all cases of death in the community.

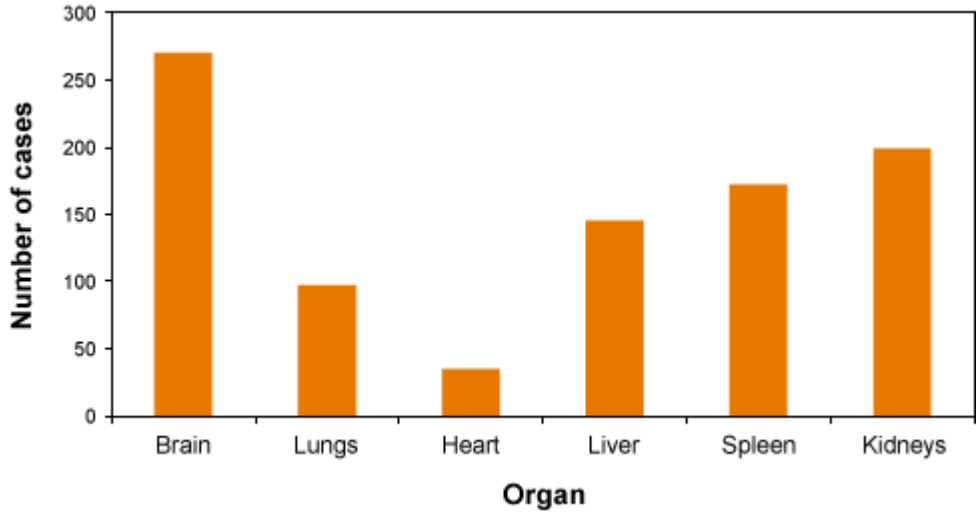
Recommendation

Normally a complete autopsy should be performed, with all organs including the brain examined. Limited autopsies - upon request - should be carefully considered on a case by case basis and when complete examination is essential to determine the cause of death the pathologist must insist upon that. If an organ system is not examined, consideration and account should be made of the potential information lost, in the context of the deceased's clinical pathology.

Organ weights

Traditionally, pathologists weigh the organs they (or their APT colleagues) remove from the body, and there is a large literature on the normal weights and weight ranges of all organs, for age and size of deceased persons. In 74% (1,252/1,691) of cases, all major organs were weighed (brain, lungs, heart, liver, spleen and kidneys). In those 439 cases that did not weigh at least one organ (Figure 10), only 32 pathologists made a note in the autopsy report that indicated why the organ was not weighed. This was commonly due to autolysis of the unweighed organ or because it was previously removed (e.g. kidney). In two cases, the pathologist noted that the brain was not weighed due to limits imposed by the coroner. All mortuaries that completed the organisational questionnaire reported having organ scales.

Figure 10: Number of cases where particular organs were not weighed



Is it worth weighing organs and recording the data? No one disputes the value of the heart weight and the depiction of left and right ventricular hypertrophy, particularly when correlated with the Body Mass Index (BMI), in assessing a range of cardiac diseases. But to be meaningful, all the other organ weights should similarly be correlated with BMI. Anecdotally, clinicians also are unimpressed by organ weights (apart from the heart) in reports; their clinically relevant measures of size derive from palpation or imaging, neither of which are expressed as weights, and so find unqualified weights unhelpful.

It is argued by some that recording the organ weights provides some form of surrogate quality measure; to weigh an organ one must at least have looked at it. The counter argument, supported by this study, is that organ descriptions can be good or bad independent of any stated weight; and left ventricular hypertrophy, even when supported by a weight, is not necessarily evaluated appropriately.

Finally, the pathology advisors had no personal knowledge that mortuary scales are actually checked for accuracy (an aspect that was not investigated in the study), so possibly vitiating any utility of weighing the organs (although NCEPOD is aware that mortuary scales should be regularly checked in accredited facilities). The NCEPOD view is that this is a debate that pathologists should have amongst themselves, and produce appropriate agreed guidelines.

Overall gross description of the internal organs

Having assessed each organ system description separately, the advisors made an overall assessment in the context of how well the gross descriptions depicted the pathological processes and contributed to the conclusion as to the cause of death.

The advisors considered that the overall gross description of the internal organs was good, satisfactory and unsatisfactory in 22% (375/1,691), 68% (1,146/1,691) and 10% (170/1,691) of cases respectively. Free text comments made by the advisors where the gross description was considered unsatisfactory included:

- Brain not examined at all (31 cases);
- Brain examined but not described satisfactorily in the context of the case (12 cases);
- Heart not described satisfactorily (15 cases);
- Musculo-skeletal system not satisfactorily examined in the context of the case, usually injury (14 cases);
- Pulmonary embolism not investigated or excluded when it appeared relevant to the case (15 cases).

Conversely, there were many very good organ descriptions across the study, indicating how many pathologists do have the intention of performing to a consistent high standard in this area e.g. case study 23 in the section entitled 'Children and the elderly'.

Decomposed bodies

From the moment of death, the tissues of a person start degenerating through the process of autolysis. This is accelerated by heat, and retarded by cold, which is why bodies should be refrigerated as soon after death as is feasible. When the process is advanced, and the person ceases to resemble what he or she was, and the skin and internal organ disintegration blurs the features between normality and pathological changes, the state is referred to as decomposition.

One percent (16/1,691) of cases were reported as significantly decomposed. The advisors considered that the majority of these cases were not examined and evaluated properly.
The most common histories in these cases were:

- Known alcohol abuse;
- Known illicit drug abuse;
- Found hanging by the neck.

The following two case studies illustrate the problem.

Case study 8

The deceased lived at home alone and had a recent history of depression. The deceased was found hanged from electric flex at the top of the stairs. No other history was known at the time of autopsy.

The entire autopsy report was:

"The body showed advanced decomposition with skin discolouration, slippage and numerous mature maggots. The facial characteristics were severely distorted. Two tattoos were present [described]. A [cable] was present around the neck.....indicating the point of suspension. There were no other signs of injury or disease."

The cause of death was given as:

1a. Asphyxia
1b. Hanging

The advisors noted there was no examination of the internal organs, nor were tissues or

fluids taken for analysis. The deceased was on medication but no drug screen was performed. In discussion the advisors wondered whether foul play had been excluded in addition to the fact that co-morbidities should have been investigated at autopsy.

Case study 9

A middle-aged alcoholic who also had a history of manic depression was found dead at home.

At autopsy, advanced decomposition was noted, with bruises and abrasions on the arms and legs. The heart was described as normal and the brain and the skull were not examined. The liver was fatty but not cirrhotic. The comment in the report was: "There was extensive autolysis of the internal organs. Therefore no samples were retained for toxicology or histologic analysis. The bruises were most probably sustained accidentally and injuries of this type are commonly found in cases of alcohol abuse". The cause of death was given as:

1a. Alcoholic liver disease

The advisor noted "No supporting evidence for cause of death". Histology and toxicology samples should have been taken and the head examined for head injury.

Careful examination can result in identification of important positive pathological findings as well as exclusion of other equally significant possibilities[13]. Examination of external injuries is difficult but important in such cases. It is possible to evaluate a useful range of possible drug toxicities in decomposed tissues, and many coroners and pathologists consider these studies to be obligatory in all cases of suspected drug toxicity and in persons found hanged.

There is a debate among pathologists as to whether the examination of all decomposed bodies should be assigned to qualified forensic pathologists or whether general pathologists can satisfactorily examine them unless there is prima facie evidence of foul play by a third party. NCEPOD cannot comment upon this debate but recommend, based on this study, that decomposed bodies be better examined.

Recommendation

Decomposed bodies should be thoroughly examined (i.e. external and internal examinations) to identify significant injuries, primary pathologies and comorbidities, and toxicology should be performed as appropriate.