

3. Results of study

Results of study

This section presents and discusses the results of the study. Where areas of potential improvement have been identified, recommendations are made. Where practicable, the results have been presented in the order by which a case is investigated: from the information that is available to the pathologist prior to autopsy, the autopsy process itself including facilities available during the autopsy, and to production of the final written autopsy report. Accordingly, this chapter contains information from both assessment forms and the organisational questionnaires.

Alongside the results, there is also discussion of the main issues that have emerged. References are made to existing guidelines or legislation, where they exist, and to the relevant literature. There are also illustrative vignettes which depict particular cases that highlight certain issues. Inevitably, many vignettes illustrate what the advisors consider to be poor practice and indicate generic means of preventing such events in future. However, some cases have been included where the advisors considered that good practice was evident. The recommendations for remedial action are placed at the ends of each section.

Finally, in the 'Overview and discussion' section, the emerging themes are drawn together and some over-arching recommendations are proposed. Because the coronial and death certification systems of England and Wales are currently awaiting new legislation and reform¹, these recommendations could have a broader application than just intended for coroners and pathologists.

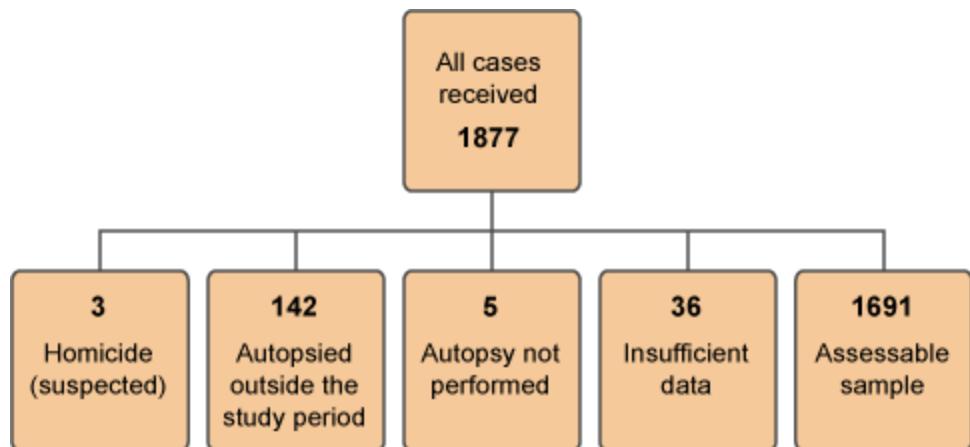
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Participation

A total of 1,877 cases were reported to NCEPOD from 121 coronial jurisdictions across the participating countries, equating to an 88% (121/137) participation rate. Coroners that did not submit cases to NCEPOD were followed up with a reminder letter. Sixteen jurisdictions did not participate. Only one of the 16 jurisdictions that did not participate in the study advised NCEPOD of their wish not to participate. The remaining jurisdictions did not reply to any correspondence.

One hundred and eighty six cases were excluded because they did not meet the study criteria. Three cases were suspected homicides, 142 cases were autopsied outside the study period, and five cases were excluded because an autopsy was not actually performed. A further 36 cases were excluded because NCEPOD did not receive the full autopsy report and therefore those cases were unable to be assessed. This left a total of 1,691 assessable cases for the study sample (Figure 1).

Figure 1: Flow chart showing summary of cases received



NCEPOD acknowledge the possibility that a sample bias may have been introduced into the study due to voluntary participation by coroners and that some cases relevant to the study week may not have been forwarded to NCEPOD. As the coroners' staff were responsible for identifying the cases to be included in the study, there was no way of checking that all cases autopsied during the study week were in fact forwarded to NCEPOD for inclusion. In a few cases the coronial investigation may not have been concluded at the time the data were requested and the lack of information may have resulted in those cases being inadvertently left out of the sample population. (Although some jurisdictions ensured that such cases were forwarded to NCEPOD once the coronial investigation was concluded).

A total of 265 organisational questionnaires were sent to all mortuaries that performed coronial autopsies. Of these, 207 questionnaires were returned (of which, 14 were returned incomplete with a note indicating that coronial autopsies were not undertaken at the mortuary). Therefore, 193 questionnaires were used for analysis, a response rate of 77%. Those mortuaries who had not returned their questionnaire by the stated deadline were followed up with a reminder letter.

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Overview of sample population

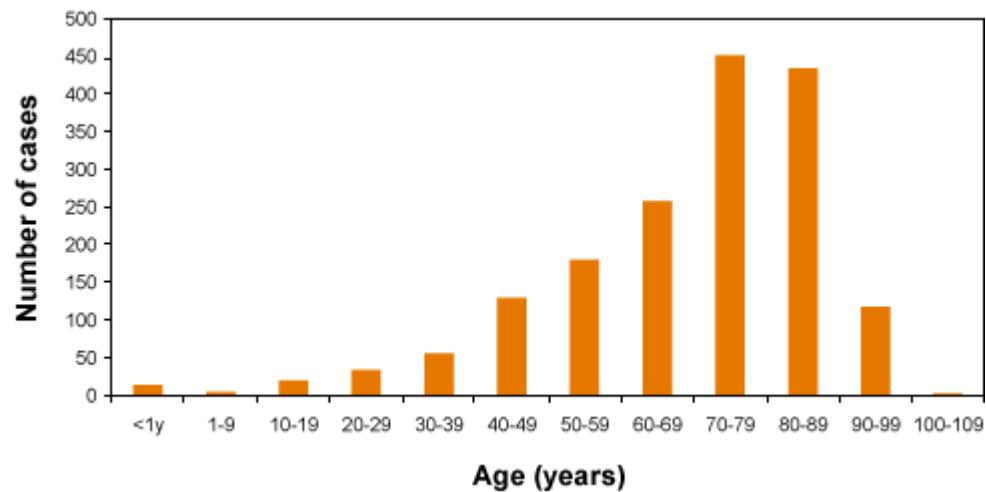
This section provides a brief overview of the sample population including:

- Age and sex;
- Category of death;
- Overall quality of the autopsy reports;
- Description of the mortuaries for which organisational data were available.

Age and sex

The sample comprised 58% (979/1,691) males and 42% (712/1,691) females with a median age of 74 years. The minimum age was three days and the maximum age was 101 years. Figure 2 shows a distribution of the age of the sample in 10 year bands.

Figure 2: Age of sample in 10 year bands



Category of death

The varying categories of death in this sample population are presented in Table 1. This categorisation represents the advisors' view as to the type of death for each case, rather than the complete cause of death as noted on the autopsy report.

Table 1: Category of death (advisors' view)

	<i>n=</i>	%
Natural cause of death in community*	929	55
Natural cause of death in hospital	351	21
Intentional self harm (suicide)	50	3
Other	55	3
Unascertained	44	3
Associated with a road traffic collision	41	2
Associated with medical intervention	20	1
Alcohol related cause of death	23	1
Natural cause of death (location not stated)	38	2
Industrial related cause of death	31	2
Associated with illicit drug overdose/poisoning	16	1
Mishap in hospital (e.g. fall)	2	0.5
Associated with fire	5	0.5
Associated with immersion	4	0.5
Sudden infant death syndrome (SIDS)	4	0.5
Multiple causes of death (including epilepsy)	78	4
TOTAL	1691	100.0

* Community refers to any place that is not a hospital, i.e. this category would include deaths in nursing / residential care homes etc.

As expected, by far the largest single group (55%) was that of natural deaths in the community. This was followed by natural deaths in hospital (21%).

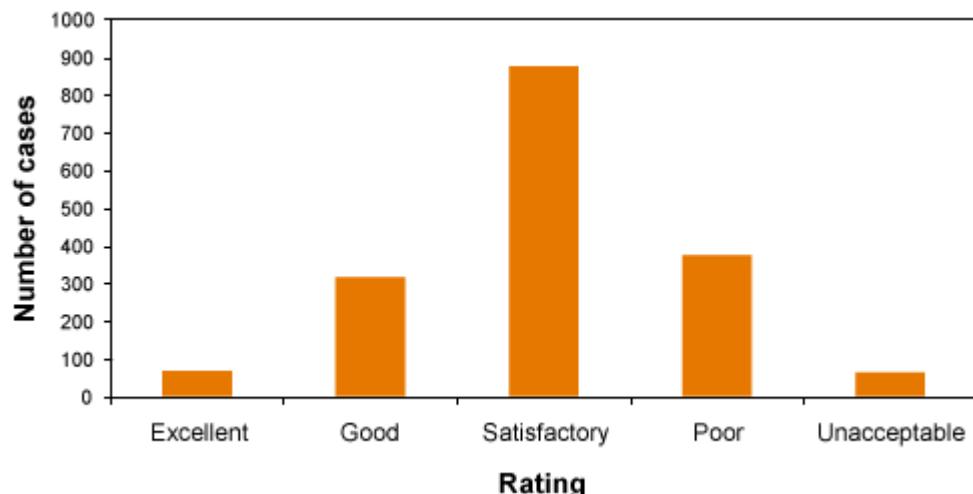
Overall quality of the autopsy reports

For each case, the advisors were asked to assess the overall quality of the autopsy report using a five point scale: excellent, good, satisfactory, poor or unacceptable. In marking the overall quality of the autopsy report, the advisors could consult their Advisor Manual and were asked to bear in mind the RCPPath Guidelines on Autopsy Practice².

Just over half of the reports 52% (873/1,691) were considered satisfactory by the advisors (Figure 3), 19% (315/1,691) were good and 4% (67/1,691) were excellent. Over a quarter were marked as poor or unacceptable. Proportionately, there were more reports rated as being 'unacceptable' for those cases being performed in a local authority mortuary (21/214 for local authority mortuary cases versus 42/1,477 for hospital mortuary cases).

Throughout the report, the overall quality of the autopsy report has been correlated with a number of different features noted in the autopsy reports and the organisational questionnaires.

Figure 3: Overall quality of autopsy reports



Mortuary types

The majority of autopsies 87% (1,477/1,691) were performed in a hospital or combined mortuary. The remaining 13% (214/1,691) were performed in a local authority (public) mortuary.

From the organisational questionnaire 92% (177/192) of mortuaries were said to be based within hospital premises (one mortuary location was not specified). Respondents were then asked to indicate on the questionnaire whether the mortuary was a: 1) hospital mortuary; 2) local authority public mortuary; or 3) combined hospital and public mortuary. A combined mortuary would be defined as a mortuary run and funded by both a hospital and a local authority, and receiving cases through both the hospital and local authority. In many instances mortuaries were defined as more than one type and so for the purpose of further analysis these data were recoded (Figure 4). Therefore any subsequent analysis using mortuary type used the recoded data; hospital and combined mortuaries have been grouped together, (175/191) and analysed against local authority mortuaries (16/191). Two mortuaries did not answer this question (Table 2).

Table 2: Mortuary type - organisational data (answers may be multiple) and recoded data

	Organisational questionnaire data	Recoded data
Hospital mortuary	171 (92%)	43 (23%)
Local authority mortuary	41 (23%)	16 (8%)
Combined mortuary	131 (69%)	132 (69%)
TOTAL		191
Not answered		2

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Assessment form results

The following sections of this report present data obtained from the assessment form (i.e. the advisors' assessment of each of the 1,691 cases). This includes an assessment of the:

- Supporting documentation; and,
- Autopsy report (demographic data, clinical history, external and internal examination, tissue retention, cause of death formulation).

Data from the organisational questionnaire has been interspersed in the relevant sections. When correlating the mortuary data with assessment form data, only those cases where an organisational questionnaire had been returned from the mortuary in which the autopsy was performed (80%, 1,360/1,691) have been used.

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Information available to pathologist prior to autopsy

In addition to individual autopsy reports, the coroners were requested to forward any additional documentation (kept on the coroner's file) that was available to the pathologist prior to the autopsy taking place (this was referred to as 'supporting documentation'). This enabled the advisors to inspect what the pathologists were provided with about each case through the coroner's office. Obviously, these data are critical to advising a pathologist about what sort of disease processes they might expect to find in each case; or that the underlying processes are simply not known.

Presented in this section is:

- Types of supporting documentation supplied alongside the autopsy cases;
- Details contained within the supporting documentation;
- Specific investigational requests;
- Overall quality of the supporting documentation;
- How coronial autopsies were requested.

Types of supporting documentation

More than 2,958 pieces of supporting documentation were forwarded alongside 1,535 autopsy cases. Many combinations of supporting documentation were received, and in 53% (888/1,691) of the cases received at least two pieces of supporting documentation. Most commonly, it was a coroner's summary report (available for 57% of cases) or a sudden death report (available for 47% of cases). Table 3 shows the number and type of supporting documents that were forwarded to NCEPOD. In 156 cases, no supporting documentation was forwarded alongside the autopsy report.

Table 3: Types of supporting documentation (answers may be multiple n=1535)

	n=	% of cases
Formal request	326	21
Sudden death report	797	52
Coroner's summary	966	63
Medical extracts	79	5*
Ambulance forms	97	6
Other	693	45

**When stratified for deaths in hospital, the proportion of cases where medical extracts formed part of the supporting documentation rose to 23%.*

Supporting documentation that was categorised as 'Other' included:

- 'Report of death' to a coroner from the hospital in which the deceased had died;
- Correspondence between coronial staff and general (or other treating) practitioners;
- Checklists (for coronial use);
- Witness statements;
- Police incident logs;
- Other documents containing the circumstances of the death;
- Other documents containing the deceased's past medical history;
- Organ retention and tissue disposal consent forms.

A number of other documents were also forwarded to NCEPOD, but these were identified to have been generated after the autopsy had taken place, and were therefore not available to the pathologist prior to the autopsy taking place. These included:

- Histology and toxicology (and other ancillary investigational) reports;
- 'Preliminary' cause of death forms (from pathologists to coroners);
- Body release forms;
- Notices to Registrar's Office;
- Documentation relating to inquests;
- Covering letters from pathologists to coroners.

NCEPOD acknowledge that pathologists may have in fact had more information available to them when conducting the autopsy than was forwarded to NCEPOD. For example, pathologists may have received verbal information either over the phone or in person from coroners' office staff, hospital or police personnel. Furthermore, many pathologists may have had access to the deceased's medical casenotes. Obviously, due to the nature of the study, NCEPOD was unable to assess the quality of this information, or how such information may have impacted on the quality of the autopsy.

Details contained within the supporting documentation

For each case, the supporting documentation was examined to identify whether or not it contained the following details (Table 4):

Table 4: Details contained within the supporting documentation (n=1535)

	<i>n</i> =	%
Deceased's date of birth	1480	96
General / treating practitioner details	1151	75
Deceased's occupation*	686	45
Specific clinicopathological questions relating to the death (directed from the coroner to the pathologist) **	119	8
Specific investigational requests or instructions (directed from the coroner to the pathologist)	35	2

* A comment that the deceased was retired was not considered to be a sufficient answer to this question, unless the supporting documentation contained the deceased's previous occupation(s). This figure excludes child cases (<=16 years). When stratified for sex, the deceased's occupation was more commonly available in male cases (51%, 448/881).

** For example: "query pulmonary embolism", "query myocardial infarction".

Four percent of cases did not have the deceased's date of birth, which was surprising as it was expected that all persons would have some documentation available by the time an autopsy is requested (which is usually 24 hours or more after the death). The exceptions would be unidentified persons, and none of the cases in the study were of such a status.

The supporting documentation in 43 of the 410 hospital cases was selected at random and retrospectively reviewed to identify whether or not the name of the consultant in charge of the patient prior to death was present (hospital cases were all those cases categorised by the advisors as: 1) natural death in hospital, 2) associated to medical intervention and 3) mishap in hospital). In 23% (10/43) of this sample, the name of the consultant in charge was noted on the supporting documentation. Looking at the autopsy reports in the same sample of cases, it was noted that the consultant's name was present in 40% (17/43) of cases. Presumably, the pathologist had sought this information directly from the hospital in which the patient died, rather than gleaning it from the coroner's information. The significance is that if pathologists have questions for the clinician with overall responsibility for the deceased patient, they need to be able to contact the treating clinicians. The doctor informing the coroner of a death is usually not the consultant but a more junior doctor, and most of the coroner's summary forms do not have a box specifically for the name and contact details of the clinician in charge.

Specific investigational requests

Thirty five cases were identified where the coroner had made a specific investigational request for the pathologist. Nine of these were requests for the pathologist to take blood for toxicology. Six requests were made for the pathologist to limit the autopsy to the thoracic cavity (in five of these cases that request was honoured). Other common requests included a direction for the pathologists to take or not take histology. In one particular case, the coroner had made a specific important investigational request to the pathologist, which was not performed (case study 1).

Case study 1

An elderly resident died in a nursing home. In the history provided by the coroner (through his officer) was the following statement and request:

"It has been brought to my attention that the Public Health Department (PHD) are investigating this nursing home on the suspicion that residents could be dying from viral meningitis... The PHD has therefore requested that lung samples are obtained and also that blood is taken in order to grow cultures".

The autopsy report documented the following gross pathologies:

Leptomeninges - normal

Lungs - patchy consolidation and purulent exudation

The cause of death was stated as:

1a. Bronchopneumonia

There was no statement to indicate whether any tissue or fluid samples had been taken; and if not, why not. It is possible that, through discussion with the coroner in person, by telephone, or writing, the issue was resolved and by agreement nothing more needed to be done. But the advisors believed that a statement should have been included in the autopsy report. One might question why 'lung' and 'blood' samples were specified by the coroner, when meningeal and blood samples would be more appropriate. This could also have been addressed in the report.

In another case, there was a request from the coroner to consider head injury (case study 2).

Case study 2

An elderly resident of a nursing home had a complex history of immobility, type 2 diabetes, visual problems and recent falls, culminating in a fall from bed with a resulting grazed head. A few days later, the patient was admitted to hospital with drowsiness and general deterioration. Pneumonia was diagnosed and a CT scan showed a large acute-on-chronic subdural haematoma. The neurosurgeons did not consider the patient suitable for surgery and the patient died a week later.

There was no history provided in the autopsy report, but the coroner's history specifically raised the question of whether the subdural haematoma was contributory to the death.

The autopsy found that there was 54g of clotted blood and a chronic subdural membrane present over the right side of the brain, with an intact skull. There was also a well described old infarct in the brain, along with cerebral atrophy. The heart showed hypertrophy with old fibrosis, and coronary artery stenosis up to 70%. The lungs showed thromboembolism filling the pulmonary arteries; and residual thrombus was present in the veins of both lower limbs. The other organs were within normal limits for age. There was no clinicopathological correlation in the report and there was a comment in the report that "Death was due to natural causes". The cause of death given was:

1a. Pulmonary embolism

1b. Lower limb phlebothrombus

2. Diabetes mellitus

There was nothing in the report addressing the circumstances raised by the coroner.

Recommendation

Specific written requests for investigations, made by a coroner, should be followed, or an account rendered in the autopsy report as to why this was not addressed.

Overall quality of the supporting documentation

Overall, the advisors considered the supporting documentation to be good, satisfactory or unsatisfactory in 16% (239/1,535), 71% (1,090/1,535) and 13% (206/1,535) of the cases respectively.

The advisors commonly marked the supporting documentation as 'unsatisfactory' because important case information that would have been available prior to the autopsy (as noted in the autopsy report) was absent in the supporting documentation. Other comments noted by the advisors where the supporting documentation was considered 'unsatisfactory' included (minimum numbers are provided in parenthesis - these reflect the number of cases where the advisors made special notes as free text additions):

- Alcohol abuse not mentioned (4 cases);
- Drug usage, both prescribed and non-prescribed, i.e. illicit (28 cases);
- Schizophrenia, dementia, epilepsy not mentioned (3 cases);
- Significant medical history, including operations and diabetes, not mentioned (50 cases);
- The occupation of the deceased, including asbestos exposure or previous diagnosis of mesothelioma, not mentioned (13 cases);
- Not enough data on hanging or trauma related to death (15 cases);
- Information just too brief or muddled (59 cases);
- Information handwritten and illegible (4 cases).

There are no details contained within the Coroners Act or Rules that describe what information should be given to a pathologist when an autopsy is requested. The information chain is potentially complex, with data provided to the coroner or his/her officer from one or more sources (general practitioner, hospital doctor, police, ambulance staff, relatives etc), and then summarised into the documentation under discussion and conveyed to the pathologist.

A study assessing quality of information supplied to pathologists was conducted by Sampson et al in 1999³. They assessed the amount and quality of information supplied to pathologists before all autopsies performed over a one year period for the coronial jurisdiction of South Yorkshire (UK). Assessing the South Yorkshire Police's Sudden Death Reports for 656 autopsy cases, the authors found that 75.8% were deemed to be suboptimal or insufficient based on a set of standards defined by seven essential criteria (name; age/date of birth; date of death; where

body found; occupation; relevant medical history; and position of body). The authors concluded that the quality of information supplied to pathologists prior to an autopsy taking place may be "suboptimal", which could affect the thoroughness of the autopsy itself.

One of the standard texts on the coronial system⁴, notes that the pathologist is 'entirely reliant' on information provided by others, and goes on to provide a checklist of significant demographic, occupational, medical and scene of death data items that should go into the history provided. The advisors concur that it is most important that this information be as comprehensive as possible, within the resources available for the coroner and his/her officers. Otherwise the autopsy may be compromised in outcome and quality from the outset (case study 3).

Case study 3

The history presented to the coroner in the case of the death of an elderly person was:

"In '93 suffered depression after [spouse] died. '96 macular degeneration, had TIA [transient ischaemic attack] in '97 further one in 2001, suffered hypertension in 2001, had a skin lesion removed in 2004. At place of death was found [a probiotic] of which a quantity was missing."

The autopsy found nothing significant externally, apart from blood oozing from the nose. Internally the heart was normal with coronary artery stenosis at a maximum of 40% in one artery and there was early bronchopneumonia in the right lung. The abdominal organs were normal and tablets/capsules were not seen in the stomach. The brain was normal and no significant abnormalities were seen in the musculo-skeletal system.

At the end of the autopsy report there is a further statement:

" I have received further information [a witness statement was available as part of the supporting documentation] that the deceased was found with a plastic bag over [the] head...in the absence of this information at the time of the post mortem I was unable to carry out some investigation which would have been done in the presence of this information. ... Toxicology was not taken. I was not able to examine the bag. In my view there is no alternative but to submit a cause of death as: 1a. Unascertained."

The advisors noted a serious problem of communication between the scene of death observers, the coroner's office and the pathologist, leading to lost opportunities in the proper investigation of suspected suicide.

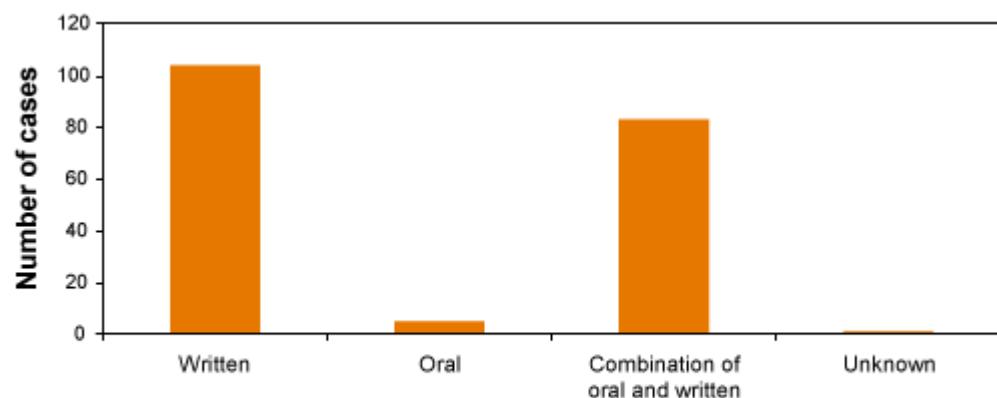
The study could not examine the organisational issues around the training and supervision of coroners' officers. Although there is a Coroners Officer Association⁵, there is not a universal standardised training for officers. How the officers glean information relevant to a death evidently varies, as does how much they pass on to the pathologist. One possibility that might be considered is that coroners' officers pass on to the pathologist, without editing, all information from their enquiries.

How were coronial autopsies requested?

Most mortuaries are not located near coroners' offices; if they are, the coroner or his/her officer can actually discuss the case with the pathologist in person, observe the autopsy, and hear directly the pathologist's opinion as to the cause of death - if the latter can provide one at the time of the examination. However, for the majority of coronial autopsies, information about each case and the request to perform an autopsy needs to be transmitted to the pathologist reliably, from a distance. Faxes, combined with phone calls, are accepted now (posting a written request would take too long).

On the organisational questionnaire, NCEPOD asked how case information was usually provided. Mortuaries could answer as either written, oral, or as a combination of both written and oral. Results show that in the majority of mortuaries (97%, 187/193) information for the autopsy are either written, or were a combination of written and oral. In 2.5% (5/193) of mortuaries instruction for autopsy are given orally only (Figure 4).

Figure 4: How autopsy case information is usually given to pathologists



Mode of information provision

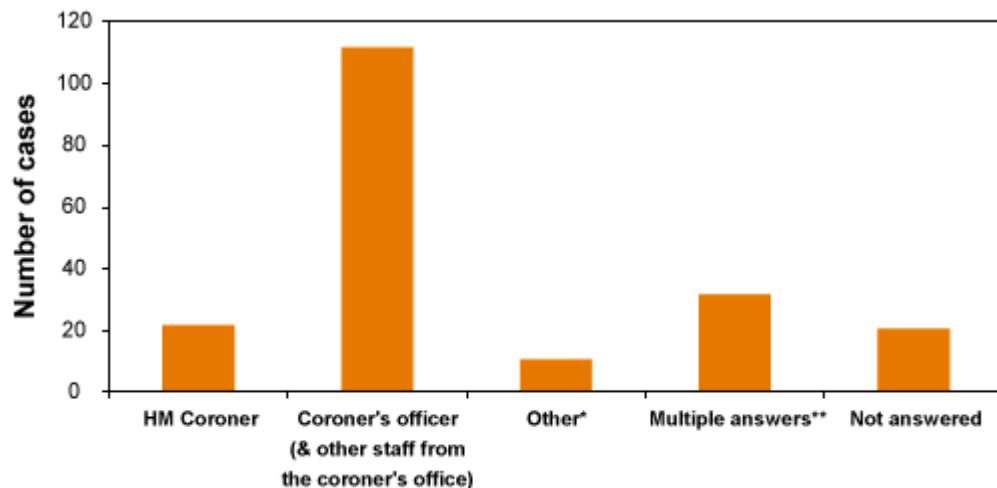
Reviewing the cases where an organisational questionnaire had been returned from the mortuary in which the autopsy was performed, it was noted with some surprise that in only 22% (30/1,360) of cases did a written request specifically to perform an autopsy form part of the supporting documentation. It may be, however, that the coroner's office reports were faxed to the mortuary and these were considered to constitute a written request for autopsy, although they were not categorised as such for this study.

These data were also correlated with mortuary type (local authority or hospital). Results showed that a higher proportion of pathologists were being given information orally in local authority mortuaries than in hospital mortuaries. Correspondingly, written only information was used more in hospital mortuaries than in local authority mortuaries (Table 5).

Table 5: Mode of information provision by mortuary type

	Hospital/combined mortuary	Local authority mortuary
Written	96	7
Oral	3	2
Combination of written and oral	75	7
TOTAL	174	16
Not answered	1	

The data were examined with regard to who usually requests the pathologist to perform an autopsy. This question was answered with varying combinations, but most commonly 64% (111/173) of staff from the coroner's office (or specifically the coroner's officer) gave the request. In 12% (21/173) of mortuaries, it was specified that only the coroner him/herself usually requests a pathologist to perform an autopsy (Figure 5).

Figure 5: Who requested an autopsy?

* 'Other' answers include bereavement officer, hospital consent form or clinician, police or police forms, and pathologist.

** Multiple answers include HM Coroner and other; Coroner's officer and other; and HM Coroner and Coroner's officer.

As discussed in 'Overall quality of the supporting documentation', the advisors considered that the information that is provided to pathologists from coroners, and the method by which it is provided, is extremely important to assist the pathologist in carrying out his/her duties to the best of his/her ability. Many of the pathologist advisors could not believe that, in 2005, information and instruction about cases for autopsy were being conveyed solely by oral communication. The examination of a deceased person has such important implications for the stated cause of death for the individual, family and society that this communication process must be better standardised. Communication should be in writing and preferably typed as in some cases it was illegible.

In light of the observed quality of the supporting documentation in this study, and of the

information obtained from the organisational questionnaire, the following recommendation is made:

Recommendation

The information provided by coroners' offices to pathologists should be in a standardised format that includes an agreed minimum clinical and scene of death dataset, including date of birth and occupation of deceased. Such information should be communicated in writing.

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Autopsy report

Schedule 2 of the Coroners Rules⁶ lists the data that should be in the report made to a coroner by a pathologist who has performed an autopsy. The traditional autopsy report that pathologists use from training onwards has a somewhat different structure: demographic data, history of the patient's illness, external examination, internal examination, additional investigations (e.g. histopathology of tissue samples), cause of death, clinicopathological correlation. In this section, that order is followed for presentation of the results and discussion.

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Demographic data

The first part of an autopsy report indicates the demographic data: who the patient was, how old they were, when and where they died, and many other important data (Table 6). The following sections relate to the information as presented in the autopsy report as a stand alone document, and not the supporting documentation (i.e. this is material that the pathologist him/herself presents in the report).

Table 6: Information contained within the autopsy report (answers may be multiple
n=1691)

	n=	% of cases
Name of the deceased	1691	100
Pathologist's name	1689	100
Date of autopsy	1675	99
Sex	1667	99
Location of autopsy	1655	98
Date of death	1624	96
Autopsy report number	1535	91
Age	1445	85
Location of death	1287	76
Date of birth	1230	73
Address of deceased	1218	72
Pathologist's appointment	1187	70
Time of death	1143	68
Coroner instructing (or jurisdiction)	1078	64
Pathologist's qualifications*	1071	63
Other persons present at the autopsy	610	36
Time of autopsy	594	35
Statement of presence (or absence) of pacemaker	561	33
Deceased identified by **	516	31
Mode of identification ***	474	28
Hospital / NHS number	355	21

* *What is a pathologist? Most of those performing the autopsies were consultants, most but not all of whom were members/fellows of the Royal College of Pathologists; there were also specialist registrars and senior house officers performing autopsies and signing reports (described in more detail later). A proportion of pathologists were forensic specialists, but the study did not distinguish those belonging to a forensic department from those who were independent, self-employed practitioners.*

** *This refers to a named person who identified the body to the pathologist.*

*** *This refers to the method by which the pathologist identified the body, for example, by wrist band.*

From the autopsy report, a note was made of the pathologists' appointment (Table 7).

Table 7: Pathologists' appointment

	<i>n=</i>	%
Consultant histopathologist	1002	59.3
Forensic pathologist	122	7.2
Specialist registrar or senior house officer	54	3.2
Associate specialist histopathologist	10	<1
Consultant neuropathologist	8	<1
Consultant paediatric pathologist	5	<1
Not stated	490	29.0
TOTAL	1691	100

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Case history

After the demographic data, an autopsy report usually contains a case history which describes the past and recent known medical history of the patient including medications, and the events that occurred around the time of death. Case history, if present, as documented in the report by the pathologist is not necessarily based on that from the coroner.

Of all cases assessed, 79% (1,340/1,691) contained a case or clinical history within the autopsy report. This figure is slightly lower than the figures quoted in previous NCEPOD reports (which have fluctuated between 84% and 89% in reports published by NCEPOD since 2000). However, the previous NCEPOD reports only included hospital deaths, which may account for a higher proportion of cases with a clinical history being included in the autopsy report as they may have more complex scenarios of death). In those reports without a history present, a common statement was "history as provided by the coroner".

The RCPPath guidelines² state that a history should always be included. However, the data requirements for an autopsy report as listed in Schedule 2 of the Coroners Rules do not include a history of the case. Nonetheless, a standard text on coronial autopsies states: "The report should contain a clinical history to make clear the context of the examination...However there is some variance as to the level of detail that may be thought appropriate"⁴.

Of the reports that did include a history, 72% (971/1,340) were essentially identical to that provided by the supporting documentation (where supporting documentation was available). Of these, it was considered that in 167 cases, additional history would have been useful to make clear the context of the autopsy. As the advisors discussed throughout the study, there is no agreement among pathologists or coroners as to the effort a pathologist should take to determine and record relevant history beyond that provided by the coroner. It is evident that in some of the reports the pathologists did make this effort, and the outcome in terms of quality grading was positive (Table 8). One standard text on the coronial system also makes the point about pathologists repeating, word for word, the entire history given them from the coroner. It continues "this is quite unnecessary and can lead to problems when any of these details are disputed by the family"⁴.

In only 10% (128/1,340) of reports, that included a history, did the history specify clinical questions to be addressed at the autopsy. This has not been an official recommendation from any organisation to date, but makes sense as it indicates the perceived issues raised by the death as seen through the eyes of the coroner and clinicians, and enables the pathologist to reflect on whether the autopsy has answered them satisfactorily. The autopsy may, of course, raise additional issues as well as resolving those considered at the time of death, and the whole case is then summarised and explained in the clinicopathological correlation. Two examples where a clinical question was included as part of the autopsy report's history are presented (case studies 4 and 5).

Case study 4

A middle-aged female had a 25 year history of multiple sclerosis which had left her chair bound. She had been seen recently by her GP for vulval thrush and she also reported recent tiredness and breathlessness. She collapsed at home and although a doctor was called and cardiopulmonary resuscitation was attempted she died at home. The clinical question posed by the coroner was "Query cardiac event?"

The autopsy diagnosis was:

- 1a. Hypertensive and ischaemic heart disease
- 1b. Multiple sclerosis

The autopsy findings were well described; the conclusions coherent; and the query answered.

Case study 5

The deceased was found at 08:30 in the morning in the downstairs toilet, slumped on the floor, after returning from a night shift. The ambulance staff suggested that the deceased had had a cardiac arrest, fallen off the toilet and banged their head on the washing machine. The coroner asked "Query if head injury is cause of death".

The autopsy diagnosis was:

- 1a. Pulmonary embolism
- 1b. Deep vein thrombosis

The organs were all well described; deep vein thrombosis confirmed in the calf muscle and a head injury excluded.

Overall, the advisors rated the history to be good or satisfactory in 89% of the reports (Table 8).

Table 8: Quality of the history as presented in the autopsy report

	n=	%
Good	242	18
Satisfactory	957	71
Unsatisfactory	141	11
TOTAL	1340	100
Not answered	351	

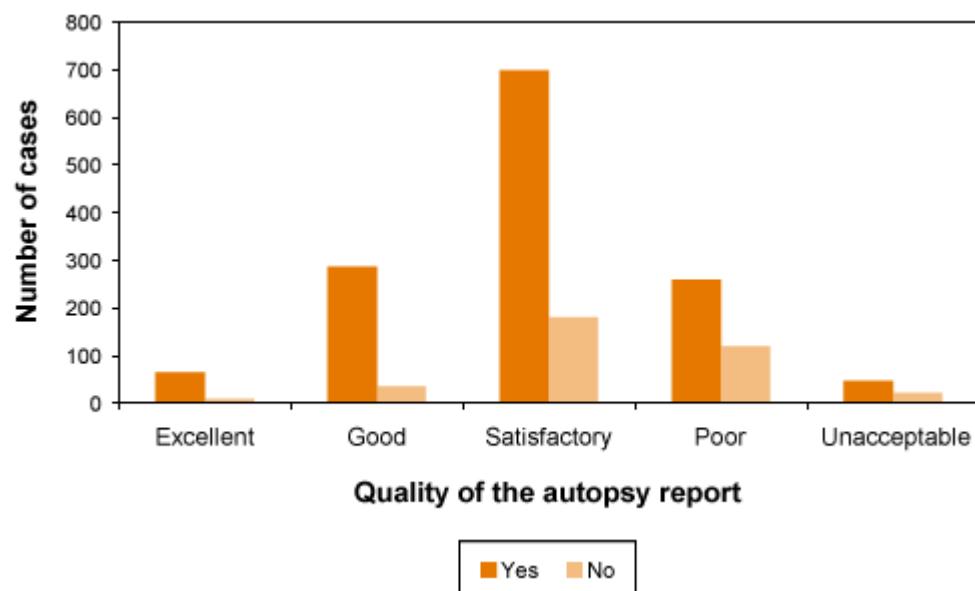
Advisors commonly noted the following reasons where a history was marked as unsatisfactory.

The autopsy report:

- omitted important past medical history (including medications);
- omitted information that was available in the supporting documentation;
- omitted important occupational history / exposure;
- was generally too brief, which gave insufficient details about the circumstances of the death.

When the overall quality of the history was stratified with location of autopsy (local authority or hospital mortuary), no difference was observed in terms of quality. When examining the advisors' opinion of the overall quality of the autopsy report in cases that did or did not contain a history, proportionately more reports were being marked as good or excellent if they contained a history (Figure 6).

Figure 6: Quality of the autopsy report in cases that did or did not include a history



The RCPPath recommend in their 2002 Guidelines on Autopsy Practice that an autopsy report should include a minimum dataset, which will normally include clinical history and how it was obtained. The equivalent autopsy practice guidelines in America (developed by the Autopsy Committee of the College of American Pathologists) also recommend that a clinical history is included in the autopsy report. Their guidelines state:

"Writing a clinical history summary enables the pathologist to address specific concerns and questions of the clinical staff regarding a patient's disease processes. Items to be considered include the following: age, gender, ethnic origin, occupation, established medical conditions and diagnoses, risk factors or characteristics pertinent to the disease processes identified, hospitalisations, surgeries, medications and pertinent laboratory data"⁷.

Like RCPPath and the College of American Pathologists, NCEPOD considers a history to be useful for readers of the autopsy report to help them to understand the context of the autopsy in the absence of any prior knowledge about the death.

Autopsy reports potentially have a wide readership. Their quality and utility in the eyes of the readers can only be enhanced by including the medical history. In a few coronial jurisdictions, however, even the pathologist is not authorised to retain a copy of the report. The Coroners Rule 10(2) states that "unless authorised by the coroner, the person making a postmortem

examination shall not supply a copy of his report to any person other than the coroner." Despite this, and in most jurisdictions, there is an increasing tendency for dissemination of reports to interested parties; as well as the pathologist, this includes relevant clinicians in hospital and general practice, families, and confidential enquiries. This is usually done with generic permission of coroners, the main exceptions being in cases where a potentially contentious inquest is forthcoming and the coroner wishes to have clinical reports unaffected (if that is possible) by detailed knowledge of the autopsy report. There has been no formal survey of families' attitudes to autopsy reports, but anecdotally the advisors felt that many families appreciate comprehensive reports that better assist them in understanding what happened and thereby to come to terms with the death.

However, there are acknowledged problems in the incorporation of a history in an autopsy report. It may be factually incorrect in minor or major aspects, as is inevitable in the process of collating information from many possible sources. Although this study found that the great majority of histories merely copied that which was presented by the coroner's office, some pathologists did provide more from their own examination of other records and from discussing the case with clinicians. It is easy to get facts wrong, as typographical errors or as misunderstandings, or because the actual source records are incorrect. Dates of operation, the precise procedure performed, laboratory data - all these may be stated incorrectly in the history. If the family observes such unintended errors and considers them significant, it can undermine confidence in the whole autopsy report and its conclusions. This leads to problems disentangling the facts at inquest, and even complaints against clinicians and health care units. A partial resolution to this issue is to indicate clearly the provenance of the history as presented; whether it came solely from the coroner's office, or with contributions from other named persons, or from the medical records etc.

Twenty one percent of the autopsy reports in this study had no history, which is congruent with the knowledge that many instructing coroners do not wish to have the history within the autopsy report. In situations where this pertains, a compromise is recommended: that the history is presented on a separate page to that of the main body of the report. This will allow the coroner to detach the history from the main body of the report if required.

Recommendation

A clinical and case history should be included in an autopsy report and should state the provenance of the information.

3. Results of study

External examination

Before the body for autopsy is opened it is usually inspected externally and various features recorded. The first and most important item is the identity of the patient, and in only 28% (474/1,691) of the reports was the mode of identification specifically noted. Usually this is done by wrist bands on the deceased giving name, date of birth and date of death; and if the death occurred in hospital, the hospital number. (In previous times, visual identification by the coroner's officer was a usual mode of identification; this is enshrined in Schedule 2 of the Coroners Rules). It is ultimately the pathologist's responsibility to ensure that he/she is examining the correct body.

For each of the 1,691 cases, the external examination as presented in the report was assessed for overall quality, and the presence or absence of the deceased's height, weight and nourishment was noted.

Height, weight and nourishment

Overall 68% (1,148/1,691) of cases recorded the deceased's height, 55% (933/1,691) recorded the deceased's weight and 66% (1,110/1,691) made a note of the deceased's nourishment status. A statement on 'nourishment' (but not height and weight) is one of the requirements listed in Schedule 2 for an autopsy report. Table 9 shows the differing combinations of height, weight and nourishment.

Table 9: Height, weight and nourishment details

	<i>n=</i>	%
All	561	33
Height & weight	316	19
Height & nourishment	201	12
Weight & nourishment	32	2
Height only	70	4
Weight only	24	1
Nourishment only	316	19
None	171	10
TOTAL	1691	100

Where available, these data were correlated with the organisational questionnaire, it was found that in the 93% (419/452) of cases where the autopsy report did not include the height of the deceased, the pathologist could have actually done so as the mortuary reported that all bodies are routinely measured. Similarly, in 50% (292/589) of the cases where the autopsy report did not include the weight of the deceased this was possible as the mortuary reported that all bodies are routinely weighed. From the organisational questionnaire 97% (188/193) of the mortuaries were reported to measure all bodies for height, and 73% (140/193) of the mortuaries were reported to have scales to weigh bodies).

Arguably, measuring body dimensions is more important than weighing most or all of the organs within. Height and weight can provide the body mass index (BMI: weight in kilograms divided by the square of the height in metres). This is a significant indicator of health status at either extreme. Obesity is a risk factor for many diseases (liver, lung, thromboembolic, musculo-skeletal etc) and appreciation of the BMI can focus attention on the real pattern of disease progression in an individual. The size of the heart is correlated with body size, and the BMI enables a better appreciation of the significance of what might appear to be a rather large or small heart⁸. BMI is also a measure of malnutrition. Comparison of BMI over time (e.g. from admission to death in a hospital case) fills in more detail over the progress of a debilitating disease. In an age of increasing concern over the care of the elderly, establishing the BMI in the old and potentially frail can provide evidence of how well they have been caring for themselves or have been cared for. BMI is more objective than a subjective comment about the deceased's nourishment (as required under Schedule 2 of the Coroners Rules 1984), and it was considered that this may be a more useful method of recording an individual's health status.

In the 2000 NCEPOD report⁹, a key point was that height and weight should always be recorded for consideration in assessing the relative size of internal organs. Then, the proportion of reports that stated weight was 45%; in the present study this had risen to 54% (910/1,691), although again one must remind the reader that the samples are not exactly the same in that the previous NCEPOD report related only to perioperative deaths.

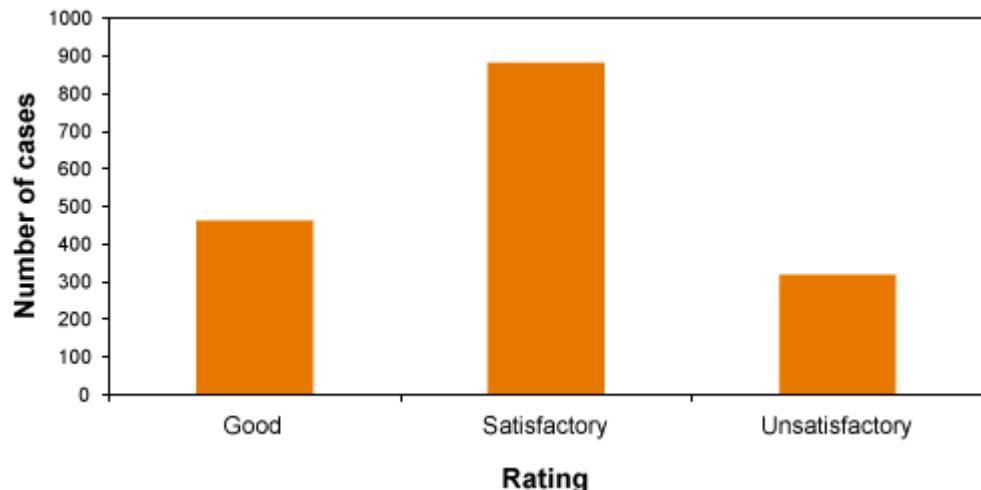
Recommendation

The height and weight should both be measured, the BMI calculated, and the data given in the report.

External appearance and identification features

In 98% of cases (1,658/1,691) a description of external appearances and some identification features was recorded. Of such cases, the advisors made the following quality assessments (Figure 7).

Figure 7: Quality of the description of the external appearances and identification features



The advisors commonly noted the following reasons for grading the external description as unsatisfactory:

- No mention of injury or trauma (or lack thereof);
- No mention of needle marks etc. in known intravenous drug users;
- Poor description of identification features;
- Inadequate or no description of surgery in cases that had recently undergone an operative procedure;
- Inadequate description of decomposed cases;
- Overall, poor, brief and no listing of important negatives in the context of the case.

The first point above accounted for approximately 70% of the cases marked as unsatisfactory. The advisors considered that it was very important, especially for deaths in the community, that all marks of injury and trauma should be accurately described, or in cases where no marks of injury or trauma are identified, that there is a statement to that effect. In the study period, nearly 80% of all the deaths occurred in the community, including many where the person was found dead without any witness observation. Following the remit of the coroner according to the Act, a major purpose of the autopsy is to investigate possible unnatural death, including traumatic. Since traumatic deaths usually produce external evidence to the fact, pathologists examining these deaths in particular should document the presence or absence of injuries, to assure the coroner and the family and the public that, at this level at least, there is, or is not, evidence of potential injury or foul play. A similar argument will be adduced when the issue is whether or not to open the skull and examine the brain in all deaths that come to autopsy (which is discussed in the section entitled 'Internal examination').

Section 8.7.5 of the RCPPath guidelines state that, in best practice, the external description should include:

"Measurements of significant surface features, scars, operations sites, bruises etc. with a clear description of the site...The presence or absence of injuries to the eyes, genitalia and anus should be recorded".

In light of the results of this study, and the best practice guidelines set out by RCPPath, the following recommendation is made.

Recommendation

In all deaths, the report must clearly document external injuries or the absence of such injuries.

3. Results of study

Evisceration of bodies

To perform an autopsy, the body has to be opened and the organs removed for detailed examination and dissection. This is the process of evisceration, a process that is carried out either by the pathologist or by the technical staff in the mortuary. After examination, the organs are replaced in the body (unless any significant parts are being retained for later examination) and the body reconstructed.

The organisational questionnaire examined two important aspects of this process:

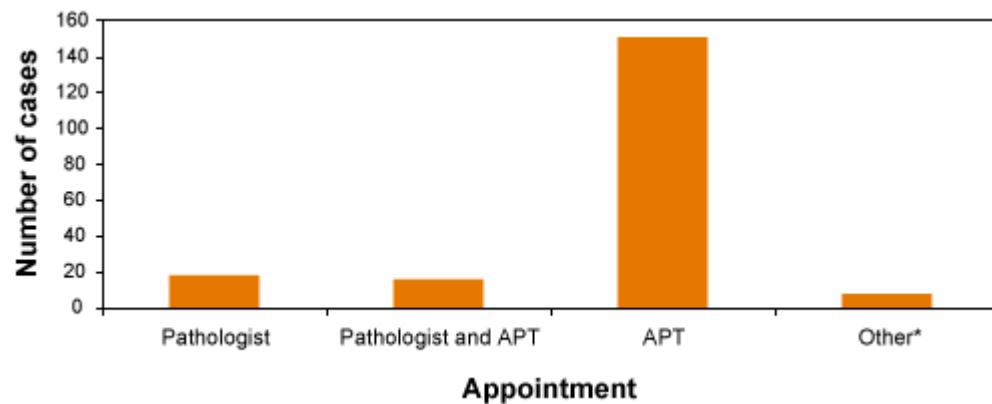
- Who performed the evisceration?
- Whether or not it was mandatory for the pathologist to inspect the body before evisceration.

Correlating these results with the assessment forms, NCEPOD considered whether the above points impact on the quality of the autopsy report itself.

Who performed the evisceration?

In 77% (149/193) of mortuaries the anatomical pathology technologist (APT) performed the evisceration, and in only 18% (34/193) of mortuaries was the pathologist normally involved with the evisceration of the bodies (Figure 8).

Figure 8: Who performed the evisceration?



* Responses on the organisational questionnaire marked as 'other' included: trainee pathologist or Resident Medical Officer. Some mortuaries made a note indicating that the person who carries out the evisceration "varies according to pathologist and case".

The factors determining who performed the evisceration are multiple, and although not specifically explored in the questionnaire, may include:

- Pressure of time, if the pathologist has several cases to examine;
- Whether the case is performed by a pathologist in training;

- Whether the case is used for APT training;
- Risk of infection.

These data were also correlated with the mortuary type (Table 10).

Table 10: Mortuary type by who performed the evisceration		
	Hospital/combined mortuary	Local authority mortuary
Pathologist	16	2
Pathologist and APT	15	1
APT	136	13
Other	8	0
Total	175	16

Did pathologists see the bodies before evisceration?

To pursue this governance aspect over autopsy performance, NCEPOD asked whether it was 'mandatory for a pathologist to see the body prior to evisceration'. In one third, 33% (63/193) of all mortuaries, it was standard practice that the pathologist was not obliged to inspect the body externally before the evisceration and organ removal commences.

Although the numbers were small, in local authority mortuaries bodies were more likely to be checked by pathologists first, compared with hospital mortuaries (Table 11).

Table 11: Type of mortuary by whether or not it is mandatory for the pathologist to see the body prior to evisceration		
	Hospital/combined mortuary	Local authority mortuary
Yes	114	14
No	60	2
Unknown	1	0
Total	175	16

These data have important implications. Only the pathologist can make the decision not to examine the body before evisceration. However, it is the responsibility of the pathologist to identify the body prior to autopsy and check that the correct body is being examined. Although the coroner and his/her officers are responsible for ensuring that the chain of evidence of identification is secure, with appropriate delegation to medical systems of body labelling (if in hospital) and to the APTs for further confirmations, ultimately it is the pathologist who is accountable if the labelling is misidentified and the wrong body is opened.

In section 11 of the RCPATH Guidelines (2002), it states that:

"Under no circumstances should an APT commence opening the body before the pathologist has checked the identity, and examined the external surface of the body nor until the pathologist is satisfied that there are no suspicious circumstances, that the death has not occurred in relation to recent surgery and that there are no allegations of suboptimal care³.

APTs are increasingly skilled health care workers and are properly and appropriately employed for this work. The RCPATH Guidelines are clear that, following inspection of the body prior to evisceration, the responsible pathologist must either be in the mortuary whilst the evisceration is being done by an APT, or be available to attend promptly should unexpected and significant gross findings become apparent during the process.

There are further guidelines that, ideally, the pathologist, or in conjunction with the APT, should make the main skin incision and remove the organs so that all abnormalities are inspected and palpated. This particularly applies to postoperative deaths, suicides, accidents and perinatal deaths. Furthermore the APT should not remove the brain from the skull before consultation with the pathologist. One standard text on the coronial system also emphasises that evisceration of the body organs 'should only be done under the direct supervision of the pathologist⁴'.

In the mortuaries with a smaller workload (<=52 cases per annum), it was more often mandatory for the pathologist to inspect the body prior to evisceration (75%), than mortuaries with a larger workload (Table 12). On the organisational questionnaire, it was indicated how many coronial autopsies were performed in the mortuary between 1st April 2004 - 31st March 2005, and the data were subsequently categorised into four groups: 52 or less a year (less than one case per week); 53 - 520 a year (10 a week); 521 - 999 a year; and more than 1000 a year. The raw data are presented as an Appendix.

Table 12: Mortuary workload by whether it was mandatory for the pathologist to see the body prior to evisceration

	Cases per annum			
	<=52	53 - 520	521 - 999	>=1000
Yes	6	66	51	6
No	2	31	25	5
Unknown	0	1	0	0
Total	8	98	76	11

Did these details about the evisceration process affect the quality of the autopsy report?

The study produced evidence that the advisors' judgement as to the quality of the autopsy report was influenced by whether or not the pathologist examined the body first. Correlation between the assessment form and the organisational questionnaire showed that the external descriptions (as described in the autopsy report) were of better quality where pathologists inspected the body

first (Table 13). And similarly, the overall quality of the autopsy report was slightly better in cases where the pathologist inspected the body first (Table 14).

Table 13: Quality of the external description by whether it was mandatory for a pathologist to see the body before evisceration (n=1338)			
	Quality of external description		
	Good	Satisfactory	Unsatisfactory
Yes	261	401	138
No	120	302	115
Unknown	0	0	1
Total	381	703	254

Table 14: Overall quality of the autopsy report in cases where it was and it was not mandatory for the pathologist to see the body prior to evisceration (n=1338)					
	Quality of autopsy report				
	Excellent	Good	Satisfactory	Poor	Unacceptable
Yes	43	188	396	149	24
No	18	81	284	138	16
Unknown	0	0	1	0	0
Total	61	269	681	287	40

From personal experience some advisors were aware of instances where evisceration of the internal organs had taken place even the day before the autopsy was performed, let alone earlier on the day of examination. Apart from the potential of an examination on the wrong body, the result is the potential obscuring of critical external marks on the body as well as of the internal arrangements of the organs and their contents (e.g. pulmonary emboli dislodged, operative procedures rendered uninterpretable). The modes of opening the body and the internal examination will often be influenced by external markings (e.g. surgical procedures) and it is important that the responsible pathologist makes the appropriate decisions to maximise the utility of the procedure.

Finally, external markings might suggest that a forensic rather than a non-forensically qualified pathologist is required for a particular case because of the possibility of third party involvement in the death. Whilst the APTs are increasingly skilled and qualified, and in the process of applying to become a formal profession with Health Professions Council regulation¹⁰, these considerations should not be left to their discretion in the absence of the pathologist.

The reasons for this significant non-compliance with recommended best autopsy practice were not explored specifically in the study, but may be conjectured to relate mainly to saving time per case for both pathologist and APT:

- To save time if the pathologist has to travel to a mortuary away from his/her normal base; some mortuaries are known to be tens of miles distant from the nearest pathology department.
- To enable many cases to be examined during one autopsy session.
- If the pathologist does not consider it important personally to examine bodies prior to autopsy.

It may be that some pathologists consult in advance with APTs, in person or by telephone, over whether certain cases may be commenced before he/she arrives. It may be that highly qualified APTs can indeed reliably assess the external features in the context of the information about the case and act accordingly so as to maximise the quality of the autopsy product. But this is not formally established in practice protocols - for pathologists, APTs or coroners - and the public may be disconcerted to realise the extent of this delegatory practice and its implications.

Recommendation

Before evisceration of a body, the pathologist must inspect the body first. This is to confirm identity, to observe any external features that might modify the process of examination and to consider the possible need for a forensic examination.

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 RCPPath guidelines specify what should go into reports as best practice³. 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

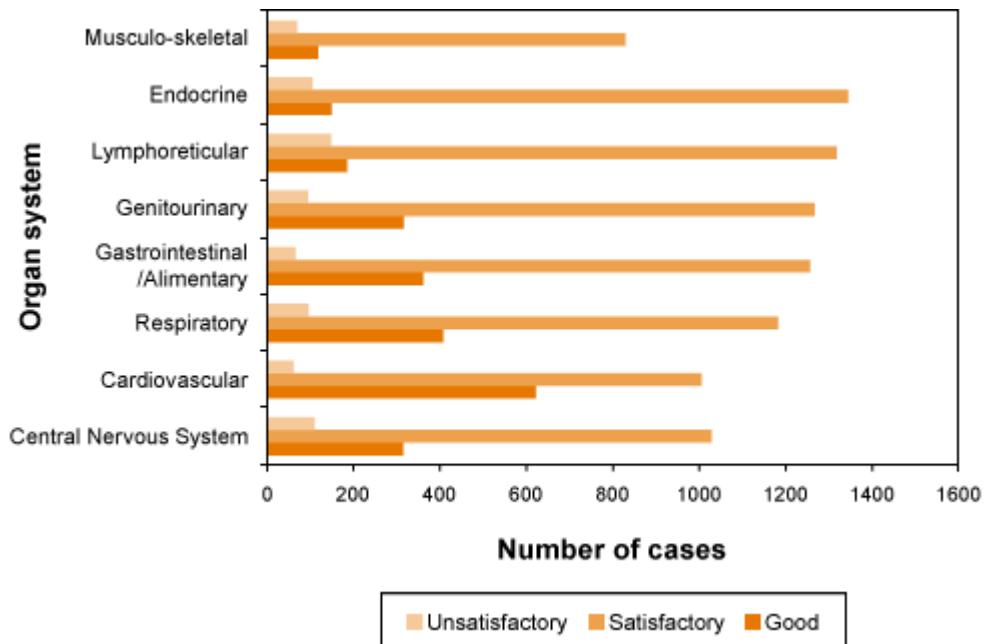


Table 15 lists the number and percentage of organs systems that were not examined.

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 report¹¹, 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 RCPPath 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 study¹². 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 criteria³) 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.

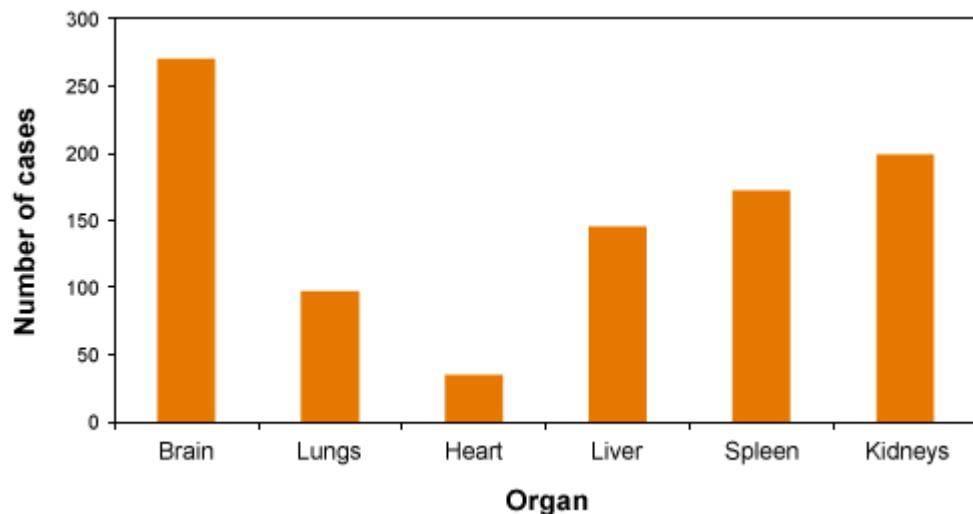
Recommendation

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 possibilities¹³. 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.

3. Results of study

Tissue retention

Pathologists retain tissue from an autopsy in order to examine it in more detail. This can be through histopathology - the study of the cellular features using a microscope, through careful gross examination of an organ once it is fixed or preserved with chemical treatment; or both processes in sequence. It is well recognised by pathologists that the naked eye examination alone cannot diagnose all pathological conditions, and that for many diseases the diagnosis can only be made with such tissue examination. 'Tissue' is defined, by the Human Tissue Authority as 'any constituent part of the human body formed by cells'¹⁷. Thus it includes whole or part whole organs, organ samples of any size, and blood.

Previous NCEPOD reports have almost all commented on the tissue sampling rates for the autopsies on perioperative deaths. These have ranged from 13-55% depending on the focus of the study. There have been several consistent features in the reports:

- All have noted that according to current best practice guidelines, histopathological sampling of all major organs is recommended for all autopsies, irrespective of authorisation (i.e. whether consented or coronial autopsy);
- All recommended more extensive tissue analysis for certain cases to improve the quality of the autopsy evaluation, whilst noting that in many cases it is not necessary to establish a cause of death;
- All noted, where comparable, that autopsies performed with consent of relatives have higher tissue sampling rates compared with coronial autopsies, usually by a factor of 1.5 to 2;
- All noted problems and conflicts between pathologists and coroners in tissue taking; the perceived impression being that coroners desire lower rates of tissue retention than pathologists.

The RCPPath guidelines are clear that (in section 9.2) sampling of all the major organs is recommended for all autopsies (consented and coronial) as best practice³. They also state the benefits that result for national statistics on death and for the family (accuracy, and ability to review a case later), and provide some guidance on communications between coroners and pathologists over this issue. The Guidelines were published in 2002, at a time of change in autopsy practice, and before the 2005 amendments to the Coroners Rules concerning tissue retention.

Tissue retention at autopsy has probably been the most contentious of all issues around the autopsy, particularly relating to coronial autopsies, in the last decade. It includes not only retention of whole organs or significant parts thereof, but small tissue samples for histopathology, blood and other samples for various analytical purposes.

Following the Bristol Royal Infirmary Inquiry¹⁴ into cardiac surgery, there emerged the recognition that children's hearts were being retained by pathologists after coronial autopsy

without knowledge of the fact by relatives. This was compounded by information on the scale of retention of perinatal autopsy tissue at the Alder Hey Hospital¹⁵ pathology unit, following autopsies authorised through consent and also the coroner, without apparent knowledge of the parents. A nationwide survey of retained organs followed, and the realisation that the 1961 Human Tissue Act was inadequate to encompass either modern pathology practice or the interest of informed consent for significant tissue retention. Consultation ensued¹⁶ which resulted in the Human Tissue Act 2004¹⁷ and the establishment of the new Human Tissue Authority with effect from April 2006¹⁸.

The Human Tissue Act covers the process of consent for retention of tissues at autopsy, and their subsequent usage for scheduled purposes, as they apply to consented autopsies, i.e. those where the relatives have given consent. It does not apply to coronial autopsies in terms of whether or not tissues are retained for diagnostic purposes - that is a decision strictly to be made by pathologists. But it does apply to the disposal of tissues taken during a coronial autopsy once the inquiry has ended and the coroner has become *functus officio*. At this point he/she cedes jurisdiction over the body and its tissues.

Historically, the residual tissue blocks and slides from the retained tissues remained in the possession of the pathologist. In most cases this meant archiving in a pathology department files for as long as the policy of that unit indicated; in the case of independent pathologists, the blocks and slides may have been stored in private premises. This has changed with the Human Tissue Act 2004. It was recognised that when the coroner is *functus*, the tissue blocks and slides belong to the relatives, not the pathologist, and appropriate consultation with relatives needs to be made, through the coroner, to ascertain the wishes of relatives regarding the disposal of the tissues taken. These options are:

- Pathologist disposes of the tissue blocks and slides (i.e. cremation or incineration); or,
- Pathologist archives the material, and consent is given for various later scheduled purposes including teaching, research etc.; or,
- The tissue blocks and slides are returned to the relatives.

The response of the Government to this tissue retention issue resulted in the amendments to the Coroners Rules 9 and 12 (2005).

It is thus important to review the regulations under which coroners and pathologists operate in this area. Until June 2005, the basis for tissue retention in a non-suspicious coronial autopsy was defined in the Coroners Rules (1984) - Rule 9:

"A person making a post-mortem examination shall make provision, so far as possible, for the preservation of material which in his opinion bears upon the cause of death for such period as the coroner thinks fit."

Following limited consultation with professional bodies, this was amended in June 2005 to:

"A pathologist shall make provision, so far as possible, for the preservation of material which in his opinion bears upon the cause of death or the identification of the deceased¹⁹."

There follows the detailed depiction of the process of ascertaining the wishes of the relatives regarding tissue disposal once the coroner is satisfied that the tissues are no longer required for his/her inquiry into the cause of death of the deceased. This information is then communicated

to the pathologist as an instruction on disposal.

The practical point is that this is a considerable logistic process, consuming time and money, undertaken through the coroner's office by him/herself or his/her staff. It has nothing directly to do with a decision on the part of the pathologist as to whether tissue retention is required for making a diagnosis in a case. But because a decision to retain material automatically imposes extra work upon the coroner's office, it is not unreasonable to suppose that the coroners and their officers might be less keen to see tissue retained in any case unless it is absolutely necessary. These changes were anticipated at the time of this study. Although the amended Rules were not formally adopted until after the study week, pathologists were aware that the coroners were moving into the new system anyway, as the new system's processes were being used.

The strict point is that the decision on whether to take histology to assist in determining the cause of death rests with the pathologist only. As will be discussed later, this is not how it always appears to be.

For this study, and in each case, the following were recorded:

- Whether or not tissue **was** taken at autopsy (as noted on the autopsy report);
- Whether or not it **should** have been taken (as assessed by the advisors);
- The quality of the tissue retention reports supplied.

The following section presents the results of the above points in addition to data taken from the organisational questionnaire relating mortuary facilities to process and store retained tissue.

Whole organs

Whole organs (or major parts) were retained at autopsy in <1% of cases (10/1,691); in four cases the lungs were retained, in three cases the brain was retained and in an additional three cases the heart was retained.

In 49% (835/1,691) of cases, a positive statement was made in the report that no whole organs or major parts were retained. The remaining 846 cases made no comment about the retention of whole organs or major parts.

The reasons for organ retention were:

- Lung (4) - mesothelioma confirmation and asbestos studies;
- Heart (3) - cardiomyopathy investigation;
- Brain (3) - case 1) paediatric neuro-developmental abnormality; case 2) traumatic brain injury in an elderly person who had a fall in the community; and case 3) to confirm suspected Lewy body dementia in an elderly male.

All these listed situations of organ retention were deemed appropriate, but they took place in <1% of all the cases in the study. The advisors considered that more organ retention should be undertaken to ensure more accurate evaluation of causes of death and further discussion follows in later sections of this report.

Histology

In 65% (1,093/1,691) of cases, a positive statement was made in the report about whether or not histology was taken. And in 19% (314/1,691) of cases, it actually was taken. The proportion of cases taking histology in this study was markedly lower than in previous NCEPOD reports, which since 2000 have ranged between 24% and 55% of cases (bearing in mind that previous NCEPOD reports have examined hospital deaths only).

In this study, 35% (598/1,691) of cases no comment was made about the retention of samples for histology. Thus in nearly half of the autopsy reports there was no positive indication that tissues were or were not retained. It is not a requirement under Schedule 2 of the Coroners Rules to indicate if tissues have been retained. However, one standard text on the coronial system notes that 'the report should make specific mention of any tissues that were retained⁴'.

The advisors believe that all autopsy reports should now state unequivocally whether or not organs or tissue and blood samples were retained. If they are retained, they should be listed; if whole organs or significant parts thereof are retained, there should be in the final autopsy report an indication of the ultimate disposal of this material. With public concern over the fate of autopsy tissues, this is a minimum requirement.

The Codes of Practice issued by the Human Tissue Authority in Jan 2006 indicate that there must be secure documentation of tissue retention, samples and organs, following autopsy examinations. It will become the duty of the designated individual named on the Licence for each mortuary to ensure that appropriate procedures are followed. One straightforward means for part of this documentation is to note in each autopsy report whether or not tissues were retained.

Recommendation

Autopsy reports must clearly indicate whether or not tissues were retained, and what they comprise, if retained.

What was taken for histological examination?

Histopathological examination was undertaken in 19% (314/1,691) of the cases in the study. Most commonly, sections of lungs were taken for histological examination (Table 16).

Table 16: Samples taken for histology (answers may be multiple $n=314$)

	<i>n=</i>	<i>%</i>
Brain	78	25
Lungs	231	74
Heart	178	57
Liver	175	56
Spleen	83	26
Kidney	131	42
Other*	147	47

* There were 'at least' 147 samples taken that were categorised as other. This is an 'at least' figure because more than one sample could have been listed as free text under 'Other' by the advisors.

Case study 10 illustrates how significant histopathological examination can be, not just for the cause of death in the deceased, but for the next of kin also.

Case study 10

An elderly patient with known emphysema developed pneumonia and, despite admission to hospital, died. The well described autopsy identified significant ischaemic heart disease and bilateral lung abscesses, as well as confirming the severe emphysema. The liver was cirrhotic (which was not previously known), and the histological features in the liver further indicated the diagnosis of alpha-1-anti-trypsin deficiency, an inherited disorder that causes both cirrhosis and emphysema.

The cause of death was given as:

- 1a. Lung abscess
- 1b. Bilateral bronchopneumonia
- 1c. Chronic obstructive pulmonary disease
2. Cirrhosis and coronary artery atheroma

The clinicopathological correlation discussed this inheritable disease and suggested that the family may wish to seek medical advice and screening.

There has been no nationwide surveys of tissue sampling in coronial autopsy practice, and so this figure of 19% of cases is a baseline datum for practice in early 2005. From the previous NCEPOD reports, which focused on investigation of perioperative deaths and where it might be supposed that the complexities of the cases would demand a higher level of autopsy histopathology examination, the range was 13-55% for tissue sampling. A recent survey by the RCPPath of hospital departments in England and Wales enquired into proportions of coronial autopsies that had histology taken and also asked about problems in the interactions with coroners over this issue²⁰. The sample size was small, but it did show the expected trend over time. In 1998, the overall tissue sampling rate was 33%, dropping to 21% in 2002 (after Bristol

and Alder Hey) and remaining at 20% in late 2005 (after the introduction of the amended Coroners Rules). This is consistent with the results of this more representative study.

Another impression coming from the RCPPath survey confirms the experience of the advisors; that there is pressure from coroners' offices not to take organs or tissue samples if a reasonable diagnosis can be made without them, and that this pressure has increased since 2000. The same point was also made in the Shipman Inquiry²¹. As indicated previously, the work that is required to observe the regulations on tissues with regards to the relatives of the deceased are time consuming, and the coroners' offices, coming under local authority financing, are not well resourced (the study did not investigate aspects of office organisation, but the fact of under resource is not disputed at coroner or government level). A self-imposed reduction of tissue taking by pathologists, because of the increased bureaucracy over tissue retention, is a factor suggested by a recent, partial survey of current practice²².

Should tissues have been retained?

For each case, the advisors were asked if the lack of tissue retention in any way detracted significantly from the autopsy report in determining the cause of death. In 6% (93/1,691) of cases it was considered that lack of tissue retention did detract from the autopsy report in determining the cause of death, and in a further 18% (307/1,691) of cases, the advisors felt that tissue retention "would have been informative". This was defined for this study in the following manner: "Tissue retention may have assisted in elucidating particular features of the death, but may not necessarily have been required to determine the cause of death".

The advisors indicated the following major issues where they believed that diagnostic histopathology was important in the case but not done:

- Cancer primary diagnosis or confirmation (41 cases);
- Liver - cirrhosis and/or alcohol related disease (20 cases);
- Heart - cause of hypertrophy and/or cardiomyopathy (17 cases);
- Tuberculosis and other pneumonias (6 cases);
- Epilepsy (5 cases);
- Stroke and other CNS disorders (7 cases).

Thus in a proportion of cases, the cause of death as given cannot be known to be correct unless there had been histological confirmation, or exclusion, of diseases suspected grossly. Gross examination identifies the pathological processes going on some but not all cases. Even standard diseases like bronchopneumonia are not accurately diagnosed by the naked eye in more than 70% of cases when compared with the histological ascertainment²³. The histological type of cancers may be guessed at, but not ascertained, by gross examination. Since the general advice for completing medical certificates on cause of death encourages entering the histological type of cancer as well as its primary site, it should be incumbent on pathologists to examine previously unknown tumours under the microscope. The coronial system needs to consider this for a national standard rather than for pathologists to do such evaluations on an individual basis. To repeat, according to the regulations, tissue retention is formally permitted only when necessary to provide a cause of death in a coronial autopsy. The coroner does not at present have a formal role in public health outside accidents. For example, he/she is not obliged to confirm or rule out possible notifiable and serious communicable diseases such as

tuberculosis and hepatitis C (a diagnosis of 'pneumonia' and 'chronic liver disease' respectively would be acceptable as a cause of death). The only specific medical disease that he/she does attempt to ascertain through the autopsy and pre-death medical data is malignant mesothelioma; this is associated with asbestos exposure, often related to industrial employment, and may involve compensation claims from the next of kin.

Case study 11 encapsulates the whole issue of tissue retention in the coronial autopsy.

Case study 11

A middle-aged patient was admitted with a history of confusion to a neurosurgical unit. The CT showed enlarged cerebral ventricles with a possible focal cerebral lesion and the cerebrospinal fluid analysis showed lymphocytosis. Whilst in hospital the patient developed colonic pseudo-obstruction which necessitated a hemicolectomy. Then a drain was inserted through the skull to relieve hydrocephalus. Unfortunately the patient suffered a cardiac arrest and died before a definite diagnosis could be made.

The autopsy revealed a massive thromboembolism in the lungs and found deep vein thrombosis in the calf veins. The spleen was moderately enlarged and although there was no generalised lymphadenopathy, lymphoma was considered. The skull burr hole for the drain was noted, the meninges were normal, the brain oedematous and on slicing the brain there was no evidence of focal abnormality to the naked eye. No tissues were taken and there was no comment apart from "Death was due to natural causes".

The cause of death was given as:

- 1a. Massive pulmonary embolism
- 1b. Deep vein thrombosis
2. Right hemicolectomy for ischaemic colitis and presumed cerebral lymphoma

Arguably the brain condition resulted in the thromboembolic final event. But what was it? The advisor noted the lack of histology and of the underlying cause of death. If the purpose of the coronial autopsy was to exclude unnatural death, then this autopsy did that. However, if it was to provide a cause of death that has medical meaning, the autopsy was deficient in not making a tissue examination of the brain to determine the pathology.

An autopsy report assessed as excellent or good overall did not need, by definition, to have tissue retained. There are certain conditions, where the gross pathology is so distinctive and where the pathogenesis is reasonably well understood, that do not require histopathological confirmation. Examples are ruptured abdominal aortic aneurysm and unequivocal acute myocardial necrosis associated with an unequivocal acute coronary artery thrombus. Case study 12 provides an example of a good autopsy report that does not include histopathology.

Case study 12

The deceased was found at home; there was no suspicion of foul play. Previous medical history included rheumatoid arthritis, deep vein thrombosis and hypertension.

The autopsy included an external description of operation scars, skin slippage and noted "There were no other signs of external injury".

Internally there was no pulmonary embolism or aspirated vomit in the airways. The heart examination noted its weight (490g) and left ventricular failure. Each coronary artery was described and the lumen narrowed to 1mm (left) and 2mm (right). The skull and brain were carefully described to exclude injury and haemorrhage.

There was a clinicopathological correlation discussing the roles of triple coronary artery disease and the history of hypertension, and noting that pulmonary oedema supported the conclusion of acute cardiac failure as the mode of death.

The cause of death was given as:

- 1a. Ischaemic and hypertensive heart disease
- 1b. Coronary artery atheroma
2. Rheumatoid arthritis

While this case is straightforward, it is emphasised because the scenario and the significant pathologies are common (ischaemic heart disease was the single commonest cause of death across the study sample). The detail of the coronary artery dimensions are such that they can be evaluated against the Davies criteria when addressing the question: 'Does the coronary artery disease observed satisfactorily account for the death of the patient?'²⁴.

A report such as this gives confidence that it represents what really happened, and in this case, whilst histopathology would be instructive for the pathologist, it was unlikely to bring out more information than was grossly visible.

Tissue processing and storage facilities

NCEPOD requested whether there were any organisational reasons inhibiting pathologists from taking histopathology samples? In terms of access to facilities for processing histology, toxicology and other laboratory investigations, 98% (190/193) of mortuaries had access to histology, 95% (180/189) to other laboratory investigations and 83% (159/191) to toxicology.

Mortuary contacts were also asked whether they had the facilities to store fixed tissues and organs. Results showed that only 64% (121/188) of mortuaries had such a facility (Table 17). These data are concerning in that one third of mortuaries could not hold fixed organs. If a pathologist wishes to retain a large organ, such as a brain, which is not transportable fresh to a laboratory, and the mortuary cannot or will not store it, what are his/her options? It could be cut and sampled fresh, but that may result in suboptimal examination for diagnostic purposes, as well as removing the opportunity to re-examine the specimen.

In future, when the Human Tissue Authority approves licences for mortuaries (see 'Clinical pathology accreditation' in Appendices), the licence will also cover storage of human tissues. Nonetheless, obtaining accreditation and an HTA licence will cost the host organisations money,

for inspection and annual retention fee.

Table 17: Storage facilities for fixed tissues and organs

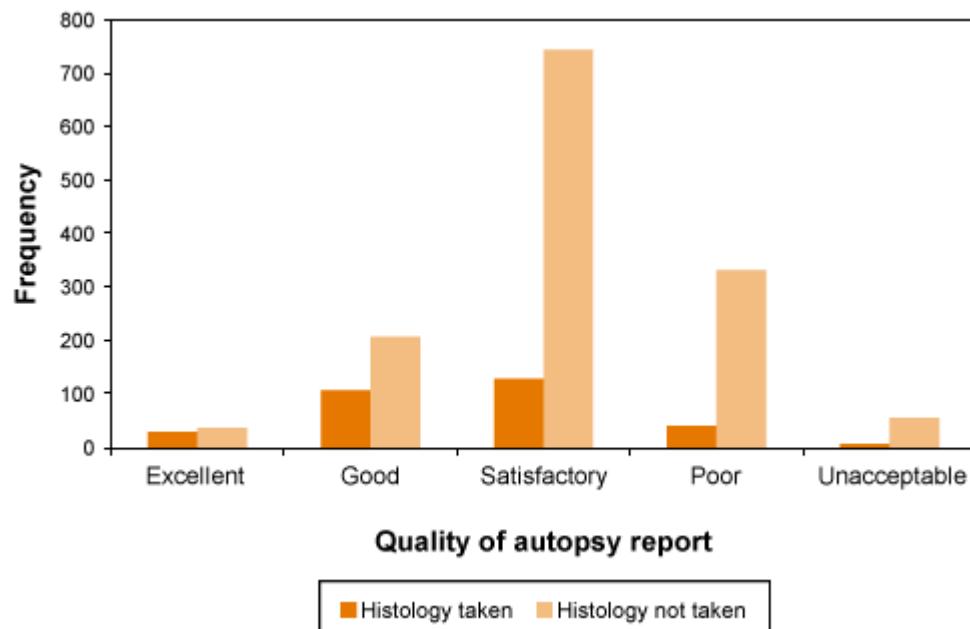
	<i>n=</i>	%
Yes	121	64
No	67	36
TOTAL	188	100
Not answered	5	

All but three mortuaries reported having access to formalin for fixation of organs (an additional one mortuary did not answer the question).

How did the retention of tissues affect the overall quality of the report?

When the overall quality of the autopsy report was stratified with whether or not histology was taken for that case, it was observed that a higher proportion of cases were rated as excellent or good in the cases where histology was taken. And conversely, proportionately more cases were rated as poor or unacceptable if histology was not taken (Figure 11).

Figure 11: Overall quality of the autopsy report in cases that did or did not take histology



Histology reports

Of the 316 cases that took histology and whole organs, 251 histology and/or whole organ reports were available to be assessed (either as separate reports or as part of the main body of the autopsy report). This represents 79% (251/316) of all cases that retained tissue.

Generally, the histology or whole organ reports were considered good in 39% of cases, (99/251) or satisfactory in 52% of cases, (130/251) by the advisors. Only 9% (22/251) of histology/whole

organ reports were marked as unsatisfactory. Some of the comments made by the advisors who had assessed the reports as unsatisfactory were:

- "Just says age related change...does not state which organs examined";
- "Type of carcinoma not stated";
- "Report does not describe findings in all tissues sampled";
- "No mention of presence or absence of asbestos bodies";
- "Described findings in stomach only - no mention of findings in other tissues sampled".

Costs of histology

One factor in deciding whether or not histopathology samples are taken is the ensuing administrative procedure, as discussed; another is money. Tissue analysis has laboratory (machine, technician, consumables) costs, though there is no agreed cost per block across UK histopathology departments. The study did not explore histology costs, but several informal surveys have highlighted the issue. One common response in the RCPPath survey²⁰ was that cost considerations impacted on the amount of tissue sampling that pathologists were permitted if tissue was retained.

How coronial autopsy histopathology is funded varies widely. For independent pathologists, there is no choice: they must pass on the costs from a laboratory to the coroner. For hospital department pathologists, there is a choice: the trust or medical school department can carry the costs in whole or in part, or the coroner can be invoiced. A NHS Management Executive document of 1991 on the allocation of pathology costs indicated that certain tests that support a wider public health benefit may be considered as general overhead costs for a hospital; but "there are special arrangements for works requested by coroners", presumably meaning that coroners should always be invoiced²⁵.

The amount that may be charged to a coroner for histopathology is reviewed regularly by a British Medical Association (BMA) committee. When the study was carried out, the rate was £25 per block, up to a maximum of £228.50. (The charge per block was increased to £31.50 in June 2005). No additional charge may be made to cover additional analyses such as immunocytochemistry. In reality it is more complicated, since some pathologists, when taking histology samples, will negotiate the overall fee for the autopsy at a higher rate than the standard basic (currently £87.70 per case for an autopsy performed under Coroners Act section 19) plus any histology. They charge instead the BMA agreed fee for a 'special examination' (undertaken under Coroners Act section 20) which is currently £251.15, and this can include the necessary histopathology costs²⁶. All departments do it differently, as the advisors knew from discussion. The NCEPOD view is that when the whole issue of criteria and practices for taking samples in coronial autopsies is debated, the costs should be calculated and apportioned appropriately, and that the agreed system should be national rather than local.

Autopsy histopathology futures

NCEPOD has consistently called for improving the quality of autopsy examinations, whilst recognising that the majority are performed to a satisfactory standard or better. One of the important means of improvement is to increase the amount of histopathological analysis done.

There is a need for a general debate amongst all interested parties on the level of diagnostic accuracy the coronial autopsy is intended to achieve. As part of that debate, one fact needs to be considered: the amount of autopsy histopathology being performed is currently declining because of the reduced number of consented hospital autopsies as well as from coronial practice changes. Pathological training is an apprenticeship undertaken through experience, rather than learning from instruction. If the number of autopsies performed continue to decline what will the next generation of pathologists be learning on if there is not a reversal in the trend? How will they gain the knowledge and the confidence to diagnose difficult autopsy conditions when the intention is to inhibit the histological examination of autopsy tissues? In the meantime, when there is disagreement between pathologist and coroner over the importance of tissue sampling, one action that pathologists can take - which was not observed in the study sample - is to state, in the autopsy report, that agreement for undertaking histopathology studies to clarify a cause of death was sought, but refused.

Because coronial autopsies are the basis of nearly all adult postmortem examinations, there should be an agreed set of criteria that pertain nationally, over such an important component of the autopsy as tissue retention for diagnosis. At present, tissue taking is only sanctioned to make a diagnosis. NCEPOD argues that there should be a broader approach with more tissue analysis taking place to provide more accurate information to families and for national statistics, specifically:

- To improve the level of accuracy of causes of death, such as specific types of cancer (see also 'Causes of death');
- To enable review of the cause of death if it is questioned later, or new information arises after the autopsy and coronial inquiry;
- To better inform families of the deceased who increasingly want explanations about what happened to cause the death.

Recommendation

There should be national criteria and standards on organ and tissue retention for histopathology in coronial autopsies, in order to provide convincing evidence of the cause of death.

Other samples

In 14% (229/1,691) of cases other samples were taken. These included (in many cases more than one sample was taken):

- Blood (180 cases);
- Urine (44 cases);
- Stomach contents (15 cases);
- Vitreous humour (10 cases);
- Bile (1 case);
- Cerebrospinal fluid (1 case).

The tests undertaken on these samples were mainly for toxicological analysis, where drug overdose or toxicity was suspected, including alcohol. The full range of requested tests was:

- Toxicological analysis of illicit and/or prescribed drugs (140 cases);
- Toxicological analysis for drugs and alcohol (21 cases);
- Alcohol only (18 cases);
- Infection studies e.g. bacteria, viruses, serology (28 cases);
- Biochemical studies, mainly glucose related (9 cases);
- Lung examination for asbestos fibres (4 cases);
- Cytogenetic analysis (in children) (3 cases);
- Carboxyhaemoglobin concentration (carbon monoxide poisoning) (1 case).

These analyses were pertinent to the cases and enabled high quality autopsy results with convincing diagnoses. Case studies 13 to 16 illustrate the appropriate use of toxicology and microbiological investigations.

Case study 13

A middle-aged patient with a past medical history that included excess alcohol intake and possible liver damage called the GP. The GP found the patient to be partially clothed and possibly drunk and called a colleague to accompany them. It was half an hour later that entry to the house was made and by this time the patient was dead.

At autopsy there was psoriasis-like dermatosis over the knees and elbows and there was also congestion of the dermal blood vessels in a marbled fashion across the body.

The macroscopic internal examination revealed the following features: cardiac hypertrophy characterised by slight chamber dilatation and coronary atheroma only amounting to 30-40% stenosis, normal liver with no cirrhosis, and all other organ systems, including the brain and skull, appeared normal.

Histology showed:

Liver: mild fibrosis (not cirrhosis), fatty change, but no alcoholic hepatitis.

Kidney: hypoxic features with scattered bacterial colonies within glomeruli. The pathologist noted that "part of these changes represents postmortem overgrowth, but the number of colonies is suggestive of significant septicaemia".

Spleen: reactive changes with scattered bacterial colonies.

Toxicology and microbiology were also performed revealing trace amounts of alcohol, paracetamol and ibuprofen only. The spleen culture resulted in a heavy growth of streptococcus group A together with a light growth of staphylococcus aureus.

Cause of death was given as:

1a. Streptococcus septicaemia

The pathologist, in the correlation, considered that the cardiac hypertrophy and liver pathology were due to alcohol. These were judged "not to be directly implicated in the

cause of death". The spleen culture and vascular changes identified macroscopically indicated "a significant septicaemia process..associated with a high mortality rate. It is likely that the infection gained entry to the body via abrasions incurred previously or possibly around the areas with psoriasis-like features".

The advisors noted that the diagnosis was made by microbiology investigation. Without it, it is not clear what the pathologist might have said instead. Thus this case highlights the importance of microbiological investigation.

Case study 14

The deceased had a past history of hypertension and psychiatric problems and was found dead face down on a sofa at home. A suicide note was found at the scene.

The autopsy examination noted the following features:

CNS: slightly swollen, no evidence of trauma to the skull or scalp.

Lungs: congested and oedematous, but no focal lesions.

Heart: enlarged and heavy (685g) with thickening and mild dilation of both ventricles. There were no obvious scars or acute changes to the myocardium. The coronary arteries showed patch to moderate atheroma with focal 60% stenosis.

Stomach: watery brown liquid in which several soft tablets and tablet debris were seen.

Liver: enlarged and grossly pale and fatty, but no focal lesions were seen. Histopathology of the liver showed mild steatohepatitis with occasional fibrous septum formation.

Toxicological analysis showed that the blood level of theophylline was high (51µg/ml) and within the range associated with deaths from theophylline toxicity.

The clinicopathological correlation stated:

"Although natural disease processes identified could account for death in isolation, the toxicological findings are in my opinion the major factor in the death. The already diseased heart will however, have almost certainly lowered the threshold of cardiotoxicity of theophylline, which can induce palpitations, arrhythmias and seizures".

The cause of death was given as:

1a. Theophylline toxicity

2. Hypertensive heart disease

The report was deemed by the advisor to be excellent.

Case study 15 illustrates what appears to be insufficient toxicological analysis in a death in the community.

Case study 15

A middle-aged known drug addict and alcoholic was found face down at home. There was no history in the autopsy report and in the 'external examination' there was no mention of injection sites or other drug-related marks-or of their absence.

The heart weighed 420g with normal ventricles. One coronary artery had an atheromatous plaque at the origin with superimposed occlusive coronary thrombosis. The other coronary arteries were normal. Lung oedema was present and the brain was not examined. There were no further investigations and the cause of death was given as:

1a. Coronary thrombosis

The advisor commented on the failure to examine and record signs of drug use and to carry out toxicology in a case of a drug addict dying in the community. The coronary thrombosis is not necessarily the only or even the main cause of death since drug toxicity (e.g. cocaine) could equally be relevant in this scenario.

The advisors were again asked whether the lack of samples (being taken) detracted significantly from the report in its account of answering the questions raised by the death.

In 4% (61/1,691) of cases, the advisors considered that the lack of samples being taken did detract significantly from the report and in 6% (96/1,691) of cases, the advisors considered that taking other samples would have been informative in more precisely categorising the cause of death.

The specific investigations that, in the advisors' opinion, should have been done were:

- Alcohol (40 cases);
- Illicit drug toxicology (63 cases);
- Glucose-related, in diabetics (12 cases);
- Microbiological studies (18 cases);
- Mast cell tryptase, to identify acute anaphylactic shock (2 cases).

Case study 16 illustrates a problem in the evaluation of unexpected death in a known alcoholic.

Case study 16

A middle-aged, known alcohol abuser was seen by the landlord to be drunk one evening and was found dead 24 hours later, in an unkempt state. At autopsy no height or weight were recorded and the brain was normal. The heart was 320g, had no coronary artery disease but the left ventricle was described as hypertrophied at 2cm thick. No further investigations were done. The comment was "natural causes" and the cause of death was given as:

- 1a. Acute left ventricular failure**
- 1b. Left ventricular hypertrophy**

The advisor stated that the issue of alcohol was not addressed at all and should have been pursued with estimation of blood and urine alcohol. If these were not significant, the

measurement of beta-hydroxybutyrate in the blood, may have been helpful as a marker of the keto-alcoholic syndrome that can cause sudden unexpected death in chronic alcoholics²⁴.

All of these, and other investigations are important in autopsy practice, according to the case, and pathologists are encouraged to request them when the results will confirm or exclude possible causes of death. Inevitably there are costs involved. Toxicology analysis is expensive and the standard screen for drugs of abuse, including alcohol, is invoiced to the coroner at a cost of approximately £250 per case. Microbiological and biochemical investigations are not always billed to coroners as they may be subsumed into the daily laboratory workload, but the standard charge at the time of the study was £25 for each direct examination or culture and should not exceed £228.50²⁷. When toxicology is performed, an inquest is automatically opened and with it are associated cost implications.

Inevitably there is a cost-benefit analysis to be made in all cases where additional tests are contemplated and therein lays much variation in actual practice. It was noted in the study that not all persons who were found dead hanged, or victims of road traffic collisions, or known illicit drug abusers, had toxicological studies performed; whereas the coroner advisors noted that in many jurisdictions, such analyses were mandatory.

Due to the number of cases where it appeared that alcohol and/or illicit drug use may have been relevant to the death, the recommendation is aimed at that group specifically.

Recommendation

Deaths in persons known or suspected to abuse alcohol and/or cases associated with drug toxicity should be properly investigated.

3. Results of study

Causes of death

Towards the end of an autopsy report is the pathologist's opinion as to the cause of death, which should be presented in the standard manner prescribed by the Office for National Statistics (ONS)²⁸. The main pathology, or the underlying cause of death, is the bottom line used in part one of the statement; significant contributing diseases are placed in part 2 of the statement. If no cause of death is discovered when the report is written, it is usually stated to be 'unascertained' or 'unascertainable'. In general, an unascertainable death would be where the pathologist is unable to establish a cause of death. This may be because the body is autolysed, or the pathologist only has part of the body to autopsy. It may also be because the death is caused by probable natural causes that cannot be proven (e.g. cardiac arrhythmias or epilepsy with no pathological findings). A cause of death can also be recorded as unascertained either because it is truly unascertainable (for the reasons above) or because the cause of death was unable to be established at autopsy and had not since been established at the time the autopsy report was prepared. For the latter, an inquest may be held and further evidence may be produced that does lead, with the autopsy findings, to a satisfactory cause of death.

All the reports gave a cause of death except 13 (<1%) cases where the cause of death was noted to be unascertained or unascertainable. In 99% of cases (1,678/1,691), the cause of death noted on the autopsy report followed the usual manner prescribed by the ONS (as judged by the advisors). This was better than the standards of death statement noted in previous reports (e.g. An Acute Problem? which dealt with complex intensive care cases)¹¹, and reflects two factors. First, the majority of deaths occurred in the community, and second, the commonest cause of death was ischaemic heart disease. Formulating this into a satisfactory cause of death sequence is relatively straightforward.

Were the listed causes of death appropriate?

The advisors were then asked to consider whether the cause of death given took into "appropriate account the clinical course and autopsy findings as presented in the report and in the supporting documentation". It was found that 18% (310/1,691) of cases did not meet this criterion, i.e. the advisors considered that the given cause of death may not be correctly written in context from the evidence available in all the paperwork present for the case. (This is lower than the figure found in another study examining medical certificates of the cause of death, which showed that 30% were wrong²⁴). The degree of disagreement with the given cause of death varied, from disagreement with the fundamental pathological process depicted (n=59), to the belief that the pathologies listed in the two parts of the cause of death statement were wrongly ordered for significance, and that important other diseases were not stated as appropriate.

From the assessment of the causes of death, there were seven specific areas where the advisors believed them to be incongruent with the information available (history and autopsy examination). The most common was the issue of cardiac enlargement (hypertrophy) as the

cause of death without appropriate investigations and correlation. Hypertension or a primary cardiomyopathy were possibilities that should have been pursued further. The other areas were cancer, infection, alcohol, possible suicide, perioperative deaths and epilepsy. The following subsections specifically discuss three of these specific areas: 1) heart disease, 2) epilepsy and 3) perioperative deaths.

Heart disease

Many of the cardiomyopathies are inherited (research progressively reveals genetic linkages in these conditions), and families may be screened when an index case is diagnosed. There is increasing concern over the apparent increase in incidence of unexpected sudden cardiac deaths (sudden adult death syndrome (SADS), which is a label for this group of heterogeneous underlying cardiovascular pathologies), where coronary artery atheroma, valvular disease and hypertension are not the underlying pathologies. One obvious potential cause for the 'increase' is that the diagnoses were not being made at autopsy previously, but instead another cause of death offered (pathologists have traditionally not liked to be seen unable to provide a positive cause of death, and in many cases of SADS, the diagnosis is made because exhaustive studies have revealed no positive findings).

Sudden unexpected cardiac deaths suspected to be related to cardiomyopathy and arrhythmias are included in the Department of Health's National Service Framework on Coronary Heart Disease³⁰, as part of the increasing awareness of SADS and to enable families who have suffered fatalities to be screened for the possibility of heart disease in asymptomatic members. Chapter 8 of this framework refers to cardiomyopathy and arrhythmia and makes reference to the RCPPath best practice scenario²⁴. Thus it is critical that all such potential cases that present as sudden unexpected death are properly investigated, in order to confirm another non-SADS diagnosis or to provide evidence for a SADS death. The RCPPath's best practice scenarios include the protocols that should be followed in such cases²⁴.

Case study 17 illustrates a case where SADS could have been considered.

Case study 17

A teenager was found dead at home. The given medical history was of "headaches, fainting, ?epilepsy, ?atrial fibrillation". The pathologist had added in the history that the cause of the fits was never discovered. At autopsy, the heart was noted to be 244g, with pericardial effusion, congested myocardium, normal valves and coronary arteries. The lungs were oedematous. The brain was congested but healthy. The comment was "Death consistent with natural causes. No toxicology or organs retained". No histopathology samples were retained either.

The cause of death was given as:

- 1a. Acute pulmonary oedema
- 1b. Chronic atrial fibrillation

The advisors considered this examination and evaluation unacceptable. The underlying diagnosis offered is not one that, unqualified, could occur in an adolescent. A cardiac abnormality is a distinct possibility, which might be inheritable, and deserves proper examination, possibly with the involvement of a specialist cardiac pathologist. Another

possibility is sudden unexpected death related to epilepsy which could be considered if all other investigations proved negative.

Recommendation

Sudden unexpected deaths suspected to be related to cardiomyopathy and arrhythmias (i.e. SADS) should be investigated according to best practice autopsy guidelines.

Epilepsy

In the study sample there were seven cases who, from the history, were known to suffer from epilepsy. In two cases, epilepsy was mentioned in the autopsy cause of death. As with SADS (above) there is concern that deaths in such patients are imperfectly evaluated in order to establish whether or not epilepsy played a role in their deaths³¹. Of particular concern are those who die suddenly and unexpectedly, where an epileptic seizure - indirectly affecting the heart - can be the cause of death. These patients require careful examination of all the internal organs, with histology, neuropathology and usually toxicological analysis of blood levels of anti-epileptic medication, in order to provide the best possible explanation of what happened. Whilst only a minority of brain examinations in patients dying of or with epilepsy reveal significant and specific lesions (abnormalities) that inform on the pathogenesis of the disease in each case, these examinations should be performed routinely. Positive and negative information is important both to evaluation of the cause of death and to help families come to terms with an epilepsy fatality. A significant neuropathological finding may also prompt clinical examination of other members of the family. The RCPPath has published a best practice scenario on the autopsy examination of those with known or suspected epilepsy²⁴.

The seven cases included a child aged under 10 years, a teenager, and the rest were adults over 50 years. All died at home or in the community, and in all it was a sudden collapse with or without an observed seizure. In one case, there was a careful gross examination, including the brain, with reference to a known pre-mortem diagnosis of Lewy body dementia with epilepsy, and the cause of death was given as those diagnoses.

Four of the reports gave the cause of death as ischaemic heart disease or hypertension, based on varying degrees of coronary artery disease and myocardial scarring or hypertrophy. In two of the cases the brain was not examined at all and in the other two it was grossly normal, and no samples were taken.

Two case studies (18 and 19) illustrate the problems of the proper analysis of possible epilepsy deaths. The second case study also highlights a problem that is inherent in this type of autopsy review study, which depends solely on paper records taken at a fixed point in time.

Case study 18

A teenager who was receiving treatment for epilepsy, had no other known illnesses, was found dead in bed one morning. The brain was described as congested and mildly swollen and the heart (385g) was dilated and mildly hypertrophied in association with a narrow aortic valve ring (measured as 5.4cm). No histology or toxicology samples were

taken. The comment made was "Death was due to natural causes".

The cause of death was given as:

- 1a. Pulmonary oedema
- 1b. Epilepsy
- 2. Aortic stenosis

The advisors considered this poor because there was no proper histological examination of the brain to better categorise the epilepsy and its consequences; nor of the heart to determine how severe the valve disease was or to exclude other cardiac lesions; nor any toxicology analysis of the blood to determine whether the patient had been taking the anti-epileptic therapy correctly.

Case study 19

A middle-aged known epileptic with a history of a previous myocardial infarction aged 35, was found dead on a settee. There was evidence of vomit and scalp and facial bruising. At autopsy a skull fracture was identified and a subdural haemorrhage had compressed the brain, which had cortical surface contusions. The heart was enlarged and showed old scarring.

No toxicology samples appear to have been taken, but there was histological confirmation of lung oedema. The autopsy report contained no clinicopathological correlation and the cause of death was given as:

- 1a. Intracranial bleed
- 1b. Head injury

Epilepsy was not mentioned, apart from in the history.

The problem in assessing such a case is the likelihood that it will go to inquest and more death scenario information provided then. Questions could be asked about the likelihood that epilepsy prompted the evident injuries, and about the recent pattern of the patient's epilepsy and its management, whether the cardiac problem might have precipitated a traumatic fall - and also about the possibility of third party involvement in the death. If the autopsy report as presented were, in contrast, to be the final word on the case, then the advisors considered it to be grossly deficient because it did not give consideration to all the relevant possibilities.

Recommendation

Deaths suspected to be related to epilepsy should be investigated properly, according to the Department of Health National Service Framework for Mental Health action plan: "Improving services for people with epilepsy".

Perioperative deaths

In the study there were several perioperative deaths, a topic on which the previous NCEPOD

reports summarised in the Introduction to this report have concentrated. The autopsies, judging from the reports, were evaluated to variable standards, as has been noted previously. In 10 cases, significant operations were not included in the cause of death statements. Case studies 20 and 21 illustrate the range the advisors observed.

Case study 20

A middle-aged patient was admitted to hospital for re-exploration of a right arterio-venous fistula, but died shortly after the procedure from intra-abdominal bleeding. The detailed clinical history from the coroner was not given in the autopsy report.

At autopsy there was no reference to the operation site although the internal examination of the abdomen showed "extensive extravasation of blood throughout the root of the mesentery". There was no mention of the fistula site at all. Other internal findings included "Large arteries shows severe calcific change with atheroma involving the main vessel generally and particularly the thoracic abdominal aorta".

The comment was "The cause of death is extensive intra-abdominal bleeding which appears to relate to the fistula site" and the cause of death was given as:

- 1a. Intra-abdominal bleeding*
- 1b. Leakage from fistula site*
- 1c. Widespread arterial disease with severe calcific atherosclerosis*

Overall the advisor deemed the external and internal organ descriptions to be unsatisfactory. The advisor commented that the autopsy report did not bear any resemblance to the clinical circumstances and findings and marked the overall quality of the report as unacceptable. Also the operation was not indicated in the cause of death sequence, where it should be.

In contrast, Case study 21 illustrates a well evaluated case of perioperative death.

Case study 21

A middle-aged patient with a history of cirrhosis, underwent surgery for a pelvic abscess, and unfortunately suffered a perforation of the bowel. This necessitated re-operation but the patient died subsequently of sepsis.

The autopsy found that the cirrhosis was not grossly evident, there was peritonitis, and also a tumour of the sigmoid colon. Histopathology was taken. The cause of death was given as:

- 1a. Multiple organ failure*
- 1b. Septic shock*
- 1c. Perforation of the small intestine following surgery for pelvic abscess*
- 2. Adenocarcinoma of the colon. Cirrhosis of the liver*

There was a good clinicopathological correlation, noting that the cirrhosis was confirmed and how it contributed to the mortality of peritonitis.

Case study 22 illustrates a case of perioperative death where the conclusion of the autopsy shows - in the advisors' view - a short-sighted approach to the cause of death.

Case study 22

The history provided following the death of an elderly patient was, "In hospital for elective removal of ureteric stent and developed unknown post-op sepsis with multi-organ failure. There is no significant past medical history. The death was not suspicious".

The autopsy noted a laparotomy wound. The heart "showed ischaemic myocardium, otherwise unremarkable. Valves unremarkable. Coronary arteries triple vessel disease with severe atherosclerosis" The urogenital system "Kidneys showed general pallor and left hydronephrosis with PUJ [pelvi-ureteric junction] stricture, otherwise unremarkable. Ureters showed left hydroureter and stent in situ. Bladder was unremarkable". Other organs were reported as normal and the comment in the report was "Death is consistent with natural causes. There were no tissue or organs retained". There was no clinicopathological summary.

Cause of death: 1a. Coronary artery disease

The advisor marked the autopsy report as unacceptable as it did not address the multi-organ failure, clinical sepsis or the recent operation and how the death related to it. Also there were no organ weights and the comment about "ischaemic myocardium" in case study 7 could be repeated here.

The recommendation that has been the key point for previous NCEPOD reports when discussing the examination of patients who have died during or after surgical procedures is repeated.

Recommendation

Deaths following medical interventions and complications require detailed investigation and consideration, and should not be summarised merely as (e.g) 'ischaemic heart disease' or other underlying comorbidity. If the procedure contributed to the death, then this should be indicated in the cause of death sequence.

Other areas of concern including inappropriate causes of death

In their overall assessment of the quality of autopsy reports, the advisors made many heterogeneous observations, noting the excellence of some reports and highlighting deficiencies of others. Among the particular deficiencies that stood out were:

- 18 cases where there might have been foul play, third party involvement or another type of unnatural death that had not been indicated in the report;
- 11 cases where possible industrial injury, mostly to the lungs, had been insufficiently evaluated;
- 10 cases where an evident or possible malignant tumour was not investigated or included in the cause of death statement;
- 17 cases where significant infection was felt to be the cause of death (including three with likely MRSA infection) and were not properly investigated;

- 16 cases where alcohol was considered to be a major undeclared factor in causing death;
- 83 cases where the brain was not examined and should have been;
- One case in which the possibility of suicide appeared not to have been considered by the pathologist.

3. Results of study

Children and the elderly

The median age of all the patients whose autopsies were reviewed was 74 years. The advisors were interested to see whether the autopsy reports were of the same quality for both children and the elderly.

Children

There were 23 children (those aged 0-16 years) in the study (1.4% of the total). The causes of death included road traffic collisions and other accidents in the community, and infectious complications of prematurity. None of this sample was a perioperative death. Table 18 shows who performed the autopsy.

Table 18: Person performing the autopsy on children		
	n=	%
Consultant histopathologist	7	31
Consultant paediatric pathologist	5	22
Forensic pathologist	4	17
Consultant neuropathologist	1	4
Not stated	6	26
TOTAL	23	100

Five of these were cases of sudden infant death syndrome (SIDS) and all were very well evaluated. Although the number is small this would suggest an endorsement of the change that has taken place in paediatric/perinatal autopsy practice over the last decade. The joint Royal College of Obstetricians and Gynaecologists and RCPPath document³² and the more recent Kennedy report¹⁴ are part of the process of improving the quality of the extremely important autopsy examinations of deaths in the perinatal period and infancy. There is increasing specialisation in paediatric practice and fewer general pathologists undertaking the work.

The overall quality of the autopsy reports in children compared to adults is shown in Table 19. Only one report was considered by the advisors to have been 'Unacceptable'. This concerned a teenager with a cardiac problem (described previously in case study 17).

Table 19: Overall quality of the autopsy reports in adult and child cases

	Excellent	Good	Satisfactory	Poor	Unacceptable
Adults (17 to 94)	63	307	850	364	60
Children (≤ 16)	4	5	12	1	1
TOTAL	67	312	862	365	61

Elderly people

The autopsy examination of the elderly is a significant component of coronial autopsy work. 59% (1,002/1,691) of the cases in the study were patients aged 70 years or more, up to 101 years of age. A large proportion of the patients had died in nursing homes. Nursing home deaths are often referred to the coroner because the attending general practitioner for the home is unable to provide a cause of death. This may be because they have not seen the patient for more than two weeks (a requirement for completing a death certificate and 28 days in Northern Ireland), they may not have been able to view the body after death or because the death was not expected and was not understood. Another reason may be because the deceased experienced a fall in the home which led to fracture of a neck of femur, then required admission to hospital.

The advisors' overall assessment of the autopsy reports in the 118 reports of those aged 90 years and more were reviewed in more detail for repeated comments, and the following issues emerged:

- the reports were brief and lacked any useful detail;
- dementia, when present, was not considered significant in the cause of death statement;
- fractures - with or without subsequent operation - were not evaluated and did not form part of the cause of death statement;
- the brain was not examined;
- ischaemic bowel was not evaluated when suspected clinically, or was not included as a cause of death;
- complaints against a hospital or nursing home being indicated as likely in the given history, yet the reports were too brief and without correlations so that they would not necessarily contribute helpful evidence;
- specific requests from the coroner to do certain investigations not apparently being done.

In contrast, case study 23 indicates a well undertaken and reported autopsy in a person aged over 90 years.

Case study 23

An elderly known hypertensive, was admitted with a fracture of the femur. An aortic valve

systolic murmur was noted. Surgery for the fracture took place four days later and initially the patient recovered but two days later acquired a chest infection and died the next day.

The detailed report included precise descriptions of the abnormal heart valves, muscle hypertrophy and old ischaemic scarring and of the unruptured aortic aneurysm. A hypoplastic kidney was noted, and in the musculo-skeletal system, the fracture and operation site had been explored. A scalp laceration and small subdural haematoma beneath (without skull fracture) were described.

There was a considered clinicopathological correlation discussing the cardiac clinical pathology and the scalp injury. The cause of death was given as:

- 1a. Congestive cardiac failure*
- 1b. Hypertensive heart disease*
- 2. Aortic valve stenosis and fractured right neck of femur*

The autopsy was performed by a SpR who probably also prepared the report. No histopathology was requested and none really needed. The advisor graded the report highly.

All 24 cases aged 95 years and over were studied in more detail; 19 were female and five male. Twenty-one (88%) died in a nursing home. All the deaths were considered to be natural, but the quality of the examinations was less good than those in the <95 year old population (Table 20). In fact, none of the reports from these elderly cases was assessed as being excellent, and proportionately more were unacceptable when compared to all other adult cases (17-94 years).

Particular concerns related to dementia and fractures. In the provided histories, five patients had dementia, but in none of the reports was this mentioned in the cause of death and in the advisors' opinion it was unlikely that dementia was not relevant to the death. Three patients died following a fall with fracture, but this was mentioned in the cause of death in only one case, and that was under part 2 of the cause of death statement; again, this appears unlikely. The significance of 'part 2' in the cause of death is that if a fall or other trauma is indicated in part 1, it usually follows that there will be an inquest. Placing it in part 2 removes that need, and so saves court time, administration time and the cost of an inquest.

Another concern for coroners and pathologists is the requirement for examining such elderly patients at autopsy. The elderly population is increasing demographically, but there is an impression that an increasing proportion of deaths are being referred to a coroner as unknown causes of death, and that this may be related to the case of Dr Harold Shipman²¹. There appears to be a greater unwillingness to provide medical certificates of causes of death in the elderly just in case there is a possibility of a third party involvement in the death. This is reflected in the proportion of all deaths reported to a coroner.

The scenarios of death in the over 95 year old cases were examined for predictability of the autopsy diagnosis when compared with the clinical information provided in the documentation and history. In half of the 24 cases, the cause of death could broadly be predicted from that information and it raises the question of suitability of referral to the coroner in these cases and the real necessity for autopsy. However, in many cases, in the absence of clinical past history, an autopsy was required. In conclusion, the advisors had concerns over the quality of autopsy examinations in the very elderly and had the impression that they were done less carefully than those on younger patients; this was not acceptable.

Table 20: Overall quality of the autopsy reports in adult cases and those aged 95 years and older

	Excellent	Good	Satisfactory	Poor	Unacceptable
Adult (17 to 94)	63	307	850	364	60
Elderly (≥ 95)	0	3	11	8	2
TOTAL	63	310	861	372	62

3. Results of study

Clinicopathological correlation

A clinicopathological correlation (CPC) can be described as an objective summary and correlation of clinical findings with gross and microscopic findings and with the results of other studies performed at autopsy, to describe the death and elucidate the sequence of events leading to death³³. A discussion or listing of the underlying cause or causes of death and the immediate cause should be included in the summary. This is additional to the stated cause of death in ONS format. Not all autopsy reports include such a commentary which, if present, is usually placed at the end of the report.

Sixty one percent (1,025/1,691) of the autopsy reports included a CPC, the majority of which were clearly expressed, consistent with the factual contents of the report and relevant to the circumstances of the death. This is similar to figures quoted in previous NCEPOD reports.

When the score given by advisors for the overall quality of the autopsy report was correlated with whether or not the report contained a CPC, it was found that those cases that contained a CPC were associated with an overall better report score. In fact, all of the cases scored as 'excellent' contained a CPC (Figure 12).

Figure 12: Overall quality of the autopsy reports in cases that did or did not include a clinicopathological correlation



The inclusion or exclusion of a CPC, like the inclusion of a clinical history at the beginning of the autopsy report, is variable. As early as the 1992/1993 NCEPOD report there was a recommendation stating:

"A concise, jargon-free explanation of the principle findings (clinicopathological correlation) should be a part of every post mortem."³⁴

The same recommendation has been repeated in a number of NCEPOD reports since then, but the rate of inclusion of such a correlation has never exceeded 68%.

The Royal College of Pathologists also support the inclusion of a CPC, stating in their Guidelines that:

"It is probably the most important part of the autopsy report for the clinician and often the coroner"³.

The American College of Pathologists³³ also support the inclusion of a CPC. Their guidelines state:

"Interpretation or explanation of autopsy findings may be crucial for educational and quality improvement purposes and to further explain the cause and manner of the patient's death. Anyone reading the autopsy report hopes to learn the cause and manner of the patient's death. It is our opinion that a clinicopathologic summary built around objective documentation is an appropriate and important endeavour for the pathologist."

One standard text⁴ on the coronial system also emphasises the importance of including a summary and conclusion in an autopsy report:

"A brief well written summary is often of considerable use to the coroner. In many cases it is unnecessary to call the pathologist to give oral evidence at court [i.e. at inquest] and a straightforward summary can be read out as the evidence [under Coroners Rule 37]. On the other hand, a report without a summary - or a summary written in incomprehensible medical terminology - presents the court with a difficulty... It is preferable for the pathologist to phrase the summary in such a way that everyone in court, most particularly the relatives of the deceased, can understand the medical cause of death'.

Examples of good correlations have been provided in previous sections.

Providing a comprehensive and comprehensible CPC benefits all the interested parties. The coroner can better understand a complex case, particularly important in perioperative deaths as has been indicated in all previous NCEPOD reports that included pathological assessment, and the relatives are more likely to come to terms with the death if they understand what happened. Finally, the pathologist is compelled to review all the circumstances of the case and attempt to account for all the features. If there are features which remain unresolved even after the autopsy and any further investigations, they can be honestly indicated.

There is a caveat which needs to be stated. Due to the way the autopsy reports and supporting documentation were collected, there was no way of knowing which cases would and did end up with an inquest (on a statistical basis, 10-12% would have eventuated in a public inquest). At inquest, the autopsy report (as seen in the study) forms the basis of the pathology evidence, but questions can be asked of it by the coroner and other interested parties; the findings can be challenged and the conclusions changed. It is possible that a proportion of the cases without CPC were those where the pathologist was aware at the time of writing the report that an inquest would be held, and thus withheld a correlation. However this cannot be the main explanation as 39% (666/1,691) of the cases studied did not have this component; and even in cases going to inquest, it is still a useful positive exercise for the pathologist to document the

3. Results of study

The autopsy report - process and format

In assessing the quality of the content of autopsy reports, NCEPOD were in a unique position to be able to reflect upon the production and 'look' of the autopsy report. The following were therefore examined:

- the time taken for the autopsy reports to be issued to the coroner;
- the autopsy reports' format;
- whether or not the overall report actually complied with the statutory requirements outlined by the Coroners Rules.

How long did it take to issue a report?

Performing an autopsy takes a certain time, depending on the case. The cause of death, if it is evident from the gross examination, can be rapidly transmitted to the coroner (by phone and/or fax), and the written report which is required under Schedule 2 of the Coroners Rules can follow later. If the autopsy report is delayed, it can significantly slow down the medicolegal process, and cause distress to families who would like to know the diagnosis and see a fuller account than just the bare cause of death.

The time (in days) that lapsed between the date the autopsy was performed and the date that the autopsy report was actually issued (signed or authorised by the pathologist) was calculated. Table 21 shows, importantly, the median number of days that lapsed between the date of autopsy and the date the report was issued in cases that did and did not take histology and/or 'other samples'.

Table 21: Time lapse between autopsy and issue of the autopsy report (days)

	All cases * (n=1081)	All cases where histology or other samples not taken (n=781)	All cases where histology and/or other samples taken (n=300)
Median (range)	4 (0-255)	2 (0-144)	15 (0-255)

** Not all autopsy reports were dated and therefore these calculations could only be performed on the 1081 cases where dates were available.*

There is often anecdotal criticism of the time taken to generate and send out autopsy reports. However, the data indicated in the table 21 are satisfactory. The turnaround time for reports that did not require further investigations was not different from that of surgical pathology reports on

large specimens. Autopsy histopathology takes time to fix and process, and to think about in a complex case. Toxicology analysis is dependent on factors within the relevant units and is usually outside the power of the pathologist to accelerate. Interestingly, the overall median time of 15 days was quicker than that from laboratories used by several of the pathology advisors. The RCPPath 2002 Guidelines recommended that provisional autopsy reports where further analysis was being done, or final reports in cases without analysis, should be issued within five working days of the autopsy. If further work is being done, then the final report should follow within one week of receipt of the outstanding investigation results.

Since then it has become apparent that provisional reports are not well received in coroners' offices, as there may be confusion as to which is the appropriate version to file and act upon when the final report comes in. If, as is strictly the case, tissue analysis is done because the cause of death is not known from the gross autopsy examination and this necessitates an inquest, then the timing of the final report with a median time of 15 days may be satisfactory; it takes time to organise an inquest. One practice familiar to the advisors in cases where histology or other sample analysis is required to form a cause of death, but when that cause of death is almost certainly going to be 'natural', is to process and examine the tissues rapidly (within a few days) whilst assuming the autopsy process to be continuing for that time. When the expected natural cause of death is declared, an inquest is not required and the coroner can write the appropriate certificate.

Finally, there are naturally family concerns over the time taken to analyse a case and give the opinion on the cause of death, as funeral arrangements have to be made. This study did not investigate this aspect further.

Autopsy report format

From this study it was observed that there was no uniform format for coronial autopsy reports, and wide variation was seen in both layout and length in the study cases. NCEPOD has previously noted that the use of a preprinted short form with blank spaces - that was more in use in the era of handwritten reports and typewriters than in the current era of computers and word-processing - was very unsatisfactory for autopsy reports as it limited the space for descriptions. Such a form was not common in the present study, most of the reports appearing to have come from stored computerised formats.

The Autopsy Committee of the College of American Pathologists has noted in their Practice Guidelines for Autopsy Pathology (1999) that:

"The autopsy findings should be recorded in a format that will make them useful to the parties who read autopsy reports or to those who abstract information from autopsy reports. This includes pathologists, clinicians, family members, lawyers, risk management officers, researchers, epidemiologists, statisticians and outcome analysts." ³³

There was one notable form that appeared in the study series which comprised of a set of tick boxes for each part of the autopsy examination, with the default set at 'N' for 'normal', and abnormalities indicated by inserting numbers in the boxes that correlated with numbered footnotes immediately below. The footnotes were synoptic. All the advisors found this format difficult to read and unsatisfactory. One advisor commented "I am certain that the pathologist did not examine the 'air sinuses' and 'middle ear' [ticked as 'N']; this is very poor for the family who may read the report". Another stated "I do not think it is satisfactory for pathologists to tick boxes like a car mechanic".

Complying with statutory requirements

As previously mentioned, Rule 10 of the Coroners Rules states that:

"The person making a post-mortem examination shall report to the coroner in the form set out in Schedule 2 or in a form to the like effect".

- Schedule 2 lists the information that should be contained within an autopsy report (Appendix).

As part of this study, the number of reports that fulfilled these requirements were sought to be identified. Many aspects of the Schedules (for England, Wales and Northern Ireland) are rarely included in autopsy reports today and accordingly 98% (1,660/1,691) of autopsy reports did not meet these statutory requirements (specified by the Rules of England and Wales). Most commonly, reports failed to meet the requirements outlined in Schedule 2 because there was no record of the time the autopsy was performed, or whether or not a pacemaker was present in the body.

Twenty three percent of the autopsy reports that did not meet the statutory requirements outlined by Schedule 2 were actually deemed overall as 'excellent' or 'good'. This finding might suggest that the requirements outlined by Schedule 2 are not all necessary for a good quality autopsy report. Nevertheless, looking at the reports that did meet the requirements, proportionately more 14% (7/49) versus 4% (60/1642) were rated as 'excellent' (Table 22).

Table 22: Overall quality of the autopsy reports in cases that did or did not meet the statutory requirements outlined by the Coroners Rules 1984

	Excellent	Good	Satisfactory	Poor	Unacceptable
Yes	7	9	21	11	1
No	60	306	852	362	62
Total	67	315	873	373	63

The Schedule 2 was drawn up a long time ago and, as these results show, needs revisiting in the light of changing practice. As previously discussed, NCEPOD would like to see two particular additions to the list of items required in an autopsy report: the history of the case, and a clinicopathological correlation.

areas of clarity and (if appropriate) of difficulty in the clinicopathological description of the death. It is not being made as a specific recommendation, but it would be helpful for all readers of autopsy reports if it were clearly stated if the report is not the final word from the pathologist, because an inquest has yet to be held.

Recommendation

There should be a clinicopathological correlation in each report that reviews the case and robustness of the conclusions based on the available evidence.

3. Results of study

What impacted upon the quality of autopsy reports?

The overall quality of the autopsy reports was presented in the previous section titled 'Overview of sample population'. To reiterate, the study sample displayed a normal distribution, with the majority of reports being marked by the advisors as satisfactory. There was roughly the same number of reports being marked good, as there was those marked poor; and similarly, there was roughly the same number of reports being marked excellent as there was those marked unacceptable.

Throughout this report, various aspects of the mortuary facilities have been correlated with certain components of the autopsy reports with this 'overall quality' score. These correlations have shown some interesting features - although it is important to note that by showing them, NCEPOD is not suggesting causality. To identify other (non-causal) associations related to the overall quality of the autopsy report, the following correlations were performed:

- quality of the autopsy report and position of the pathologist;
- quality of the autopsy report and mortuary workload.

Finally, the quality of the autopsy report was examined with respect to the profession of the advisors (coroners or pathologists), recognising that their professional backgrounds and experiences may have affected the way in which they mark cases.

Quality of autopsy report and the position of pathologist

Most coronial autopsies are performed and reported by consultant pathologists or senior equivalents in medical schools and in forensic medicine practice. But all autopsy pathologists have to be trained and gain experience. With the reducing numbers of consented autopsies nationally (see Introduction), the significance of the coronial autopsy is progressively augmented for training. This study could not specifically identify how many autopsies had been utilised as part of training, but it did note when trainee pathologists had their names indicated on the reports (if they were the sole authors of the report).

Some excellent reports were those prepared by specialist registrars (SpR) and other trainee pathologists. In fact, when stratifying the overall quality of the autopsy report by position of pathologists, it was found that SpRs and paediatric pathologists produced better quality reports than consultant histopathologists and Home Office (forensic) pathologists (Table 23).

Table 23: Overall quality of the autopsy report by specialty of pathologist

	Excellent	Good	Satisfactory	Poor	Unacceptable
Histopathologist	30	188	522	240	22
Forensic pathologist	9	21	61	20	11
Neuropathologist	1	2	5	0	0
Paediatric pathologist	2	1	2	0	0
Associate specialist histopathologist	0	2	6	2	0
SpR (or other trainee)	9	18	19	7	1
Unknown	16	83	258	104	29
Total	67	315	873	373	63

It is notable that forensic pathologists had the highest proportion of unacceptable autopsy reports compared with other specialties. This is worrying since, anecdotally, it is believed that they perform proportionately more coronial autopsies than hospital pathologists. However, the study did not document individual or specialty workloads and could analyse this further. Conversely it is encouraging to see the high quality of trainees' reports. This supports the utility of coronial autopsies as, *inter alia*, a training procedure - and numerically the most important since consented adult autopsies are now uncommon. It also supports the suggestion that all pathologists start at a high quality level with regard to coronial autopsy practice, but then may slip in standards (see Overview and discussion section).

How many autopsies did pathologists perform?

One concern that has been indicated in previous NCEPOD reports, that may relate to poor quality of autopsy performance and reporting, is workloads for pathologists, with too many cases being done within limited time. The Shipman Inquiry made a similar point in the 3rd Report²¹. The study design and confidentiality of this study made it impossible to quantify this, so it was not known how many pathologists were undertaking autopsies and the numbers performed by each (and a one week sample would, of course, not be representative for the workloads of all autopsy active pathologists). With an estimation of the number of autopsy active pathologists in England and Wales at 700, and the known number of coronial autopsies performed in 2005 (114,600), the average is 164 cases per annum. There are no survey data available, but it is likely that the distribution of work is skewed, with a small number of pathologists doing a notably above average number of autopsies.

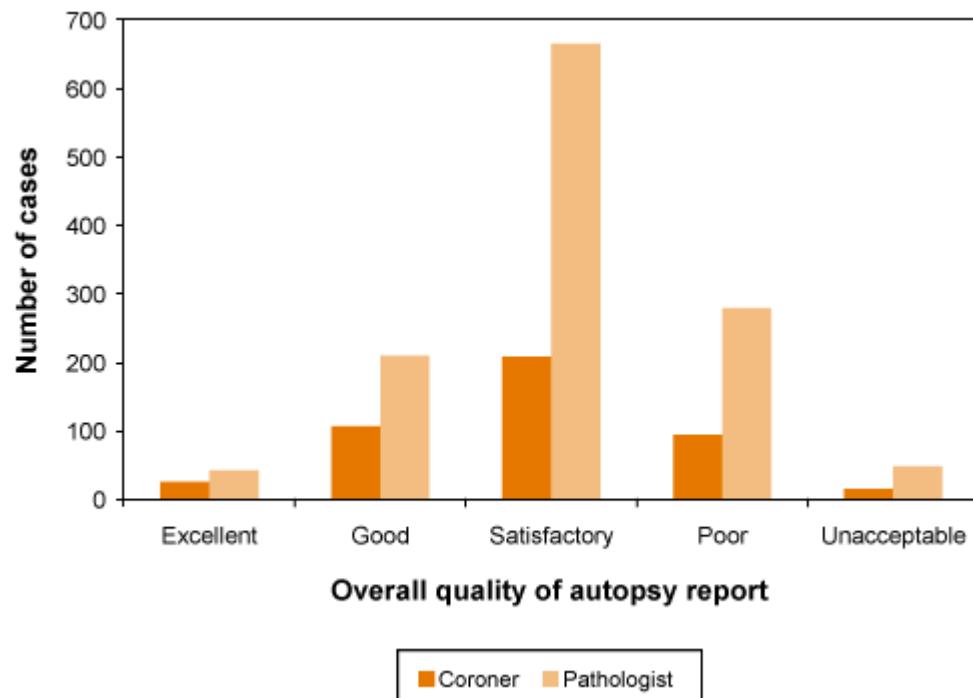
Quality of autopsy report and profession of advisor

The advisors for this study comprised both practicing coroners and pathologists. It was understood from the outset that the manner in which they assess autopsy reports may differ

depending on their professional background and preconceived ideas concerning what constitutes a quality autopsy report. Recognising this, the meetings held to assess each case in the study comprised both coroners and pathologists, so that the possible differing views could be discussed between the advisors as a group.

As each case was assessed only once by one advisor, formal inter-rater variability was not assessed. However, many of the results were stratified by profession of advisor to identify if there were any general differences in the way coroners and pathologists assessed each case. This analysis identified that overall a higher number of cases scored by pathologists were marked as 'excellent' or 'good', (Figure 13). However, proportionately more cases were marked as 'excellent' or 'good' by coroners when calculated as a percentage of the total number of cases reviewed by coroners.

Figure 13: Overall quality of the autopsy report by profession of advisor



3. Results of study

The mortuary

To perform an autopsy, a mortuary is needed. This incorporates not only body storage facilities but also a dissecting room or rooms, with a range of essential equipment and facilities needed to examine a body.

The organisational questionnaire was designed to gather information about the mortuary facilities available to pathologists who perform coronial autopsies. Some of the most relevant facility features that may have impacted upon the quality of autopsy reports were presented previously (e.g. how coronial autopsies are requested, evisceration of bodies, body and organ scales, facilities to process and store tissues and other samples etc.). The remaining data that were gleaned from the organisational questionnaire are presented in full in the Appendix. Of note, there were three key recommendations that came out of such data which are presented here; they relate to:

- Pathologist's clothing;
- Infectious and serious communicable disease management;
- Mortuary accreditation.

The data and commentary surrounding these recommendations are presented in the Appendix, but are also presented here in summary.

In 81% (156/193) of mortuaries, the pathologists wear proper dress (protective clothing over surgical scrubs), although in some mortuaries, protective clothing is worn over day clothes. NCEPOD hold that in all mortuaries, the pathologists should be wearing protective clothing over surgical scrubs and make the following recommendation:

Recommendation

Pathologists should wear protective clothing over appropriate scrub suits, not over their day clothes.

The number of mortuaries that were accredited with clinical pathology accreditation was assessed. Seventy three percent (140/183) of mortuaries were accredited (10 did not know whether they were accredited or not) and accordingly, the following recommendation is made:

Recommendation

All mortuaries should be quality accredited.

A surprising reluctance on the part of many mortuaries to examine bodies with known or suspected Serious Communicable Disease was found. The proportions of mortuaries that did not accept cases were respectively: for tuberculosis - 22% (42/192), hepatitis B - 30% (58/192), hepatitis C - 36% (69/191), HIV - 52% (99/191), CJD - 80% (154/189).

Recommendation

The approach to infectious disease management in mortuaries should be reviewed and standardised.

3. Results of study

References

1. Coroner Reform: The Government's Draft Bill. *Improving death investigation in England and Wales*. Cm 6849, June 2006.
<http://www.official-documents.co.uk/document/cm68/6849/6849.pdf>.
2. The Royal College of Pathologists. *Guidelines on autopsy practice*. Report of a working group of The Royal College of Pathologists, 2002.
3. Sampson, H., Johnson, A., Carter, N & Rutty, G.(1999). *Information before coronial necropsy: how much should be available?* J Clin Pathol 52:856-859.
4. Dorries, C. (2004) Coroners' Courts. *A guide to law and practice*, 2nd ed, Oxford University Press.
5. www.coronersofficer.org.uk.
6. Coroners Rules (1984) Legislation Direct UK Sis SI 1984/522. Butterworth Direct.
7. Hutchins, G.M., Berman, J.J., Moore, G.W., Hanzlick, R. & The Autopsy Committee of the College of American Pathologists, (1999). *Practice Guidelines for Autopsy Pathology*. Arch Pathol Lab Med. 123:1085-1092.
8. Price, G.N.R., Cordner, S.M., Lynch, M.J., Dodd M.J., Ranson, D.L. & Burke, M.P. *Normal Human Heart Weights in 250 Obese Subjects (BMI>30)*. Victorian Institute of Forensic Medicine, Australia, 2002, Unpublished.
9. National Confidential Enquiry into Perioperative Deaths. *Then and Now*. London, 2000.
10. Association of Anatomical Pathology Technicians. www.aaptuk.org/future_regulation.htm
11. The Report of the National Confidential Enquiry into Perioperative Deaths 1994/1995. NCEPOD London, 1997.
12. National Confidential Enquiry into Patient Outcome and Death. *An acute problem?* NCEPOD, London 2005.
13. Saukko, P. & Knight, B. (2004). *Knight's Forensic Pathology*, 3rd Ed, Hodder Arnold.
14. Kennedy I. *The report of the public inquiry into children's heart surgery at the Bristol Royal Infirmary 1984-1995. Learning from Bristol*. 2001: The Stationery Office Limited.
15. The Report of the Royal Liverpool Children's Inquiry (2001). www.rlcinquiry.org.uk/
16. Department of Health, Consultations on Regulations to made under the Human Tissue Act 2004, July 2005.
17. Human Tissue Act 2004.
18. Human Tissue Authority www.hta.gov.uk
19. Coroner's (Amendment) Rules 2005. No. 420. Crown Copyright. June 2005.

20. Royal College of Pathologists Specialist Advisory Committee for Histopathology, Personal Communication.
21. Smith, J. The Shipman Inquiry. *Third report - death certification and the investigation of deaths by coroners*. 2003; Crown Copyright.
22. Delany, RJ., Roberts, ISD. Implementation of the 2005 Coroners Rules *Amendments - a survey of practices in England and Wales*. J. Clin. Pathol. 2006; epub ahead of print 23 June 2006. On <http://jcp.bmjjournals.com/cgi/content/abstract/jcp.2005.036178v2>
23. Hunt, CR., Benbow, EW., Knox, WF., McMahon, RF. & McWilliams, RJ. *Can histopathologists diagnose bronchopneumonia?* Journal Clinical Pathology, 1995; 48:120-3.
24. The Royal College of Pathologists, Guidelines on Autopsy Practice - *Best Practice Scenarios*, January 2005. www.rcpath.org/index.asp?PageID=687
25. National Health Service Management Executive FDL(91)127: *Allocation of pathology costs and pricing of diagnostic laboratory tests*.
26. *Revised fees for doctors assisting local authorities*, Circular DC No xxx. *Joint Negotiating Committee for doctors assisting local authorities*. BMA, London, 01 April 2004.
27. *Revised fees for doctors assisting local authorities*, Circular DC No 33. *Joint Negotiating Committee for doctors assisting local authorities*. BMA, London, 30 April 2002.
28. General Registrar's Office, 2005. www.gro.gov.uk/medcert Accessed 2nd May 2006
29. Clarke, A. & Gladwin, J. *Improving Health of the living? An investigation into death certification and coronial services and some suggestion for change*. Final report from the London School of Hygiene and Tropical Medicine to the Fundamental Review of Death Certification and Coroner Services in England, Wales and Northern Ireland, January 2003.
30. Department of Health National Service Framework for Coronary Heart Disease, 2000. http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4094275&chk=eTacxC
31. Department of Health. *Improving services for people with epilepsy: Department of Health action plan in response to the National Clinical Audit of epilepsy-related death*, 2003. http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPolicyAndGuidanceArticle/fs/en?CONTENT_ID=4010537&chk=cpRU5z
32. Joint working party of the Royal College of Obstetricians and the Royal College of Pathologists. Report on Fetal and perinatal pathology, London: RCOG, 1998.
33. Hutchins, G.M., Berman, J.J., Moore, G.W., Hanzlick, R. & The Autopsy Committee of the College of American Pathologists. (1999). Practice Guidelines for Autopsy Pathology. Arch Pathol Lab Med. 123: 1085-1092.
34. The Report of the National Confidential Enquiry into Perioperative Deaths 1992/93. NCEPOD, London 1995.