Forensic Pathology - Code of Practice and Performance Standards in NSW

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Summary The purpose of this Policy Directive is to support all health practitioners requested to perform post-mortem examinations (including external examinations) on behalf of the Coroners in NSW within the NSW Health System. It refers to the management of activities of medical practitioners (or other practitioners) under the Coroner's Act 2009 - specifically where medical practitioners are deemed to be an appropriate medical investigator and given a post-mortem investigation direction for examination of the remains.

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Applies to Local Health Districts, Specialty Network Governed Statutory Health Corporations, Affiliated Health Organisations, Government Medical Officers, Public Hospitals

Audience Pathologists, Morgue Attendants, Coronial Medical Officers, Emergency Departments

Distributed to Public Health System, Divisions of General Practice, Government Medical Officers, Ministry of Health

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Director-General

This Policy Directive may be varied, withdrawn or replaced at any time. Compliance with this directive is mandatory for NSW Health and is a condition of subsidy for public health organisations.
Purpose:
The purpose of this Policy Directive is to support all health practitioners requested to perform post-mortem examinations on behalf of the Coroners in NSW within the NSW Health System. It refers to the management of activities of medical practitioners (or other practitioners) under the 'Coroner’s Act 2009' – specifically where medical practitioners are deemed to be an appropriate medical investigator and given a post-mortem investigation direction for examination of the remains.

Mandatory Requirements:

In relation to Coronal Matters:

1. Generally, only appointed Coronal Medical Officers and specialist Forensic Pathologists (or their supervised trainees) should perform post-mortem procedures (including ordering radiology or taking specimens for testing) associated with the 'Coroners Act 2009' unless this is first discussed with a specialist forensic pathology unit (Glebe or Newcastle).

2. All autopsies, investigations, reports and any other aspects relating to death investigations are to be conducted in accordance with the requirements of the Expert Witness Code of Conduct in Schedule 7 of the NSW Uniform Civil Procedure Rules 2005.

3. Complex cases must be discussed with a Specialist Forensic Pathologist and will usually be referred to the appropriate Department of Forensic Medicine. Such cases include:
   - All homicides and suspicious deaths
   - Deaths requiring attendance by police at the autopsy
   - High profile deaths or deaths which are a matter of public interest
   - Cases with identification issues
   - Skeletal remains
   - Accidents involving aviation, marine transport, trains and buses
   - Multiple-death incidents and mass fatalities
   - Any case requiring disaster victim identification procedures
   - Workplace-related deaths
   - Diving and scuba-related deaths
   - Sudden unexpected infant deaths (see PD2008_070) and deaths of children under the age of 15 years
   - Maternal deaths
   - Infectious deaths requiring specific protocols (eg HIV, active tuberculosis, Creutzfeldt–Jakob disease)
• Deaths where the person died in circumstances where the person’s death was not the reasonably expected outcome of a health procedure carried out in relation to that person
• Deaths of foreign nationals or tourists
• All deaths in custody, or police action-related deaths.
• Any death outside the practitioner’s normal scope of practice

Education and training
Any staff directed to perform actions under the Coroner's Act 2009 should carefully consider the level of their competency and their ability to provide an appropriate post-mortem report (including interpretation of tests performed post-mortem rather than ante-mortem) according to the Expert Witness Code of Conduct in Schedule 7 of the NSW Uniform Civil Procedure Rules 2005.

Practitioners requested to perform duties outside their competency are advised to inform the Coroner of this as undertaking such duties may breach other ethical requirements of their work.

IMPLEMENTATION
Chief Executives must ensure:
• Local protocols are developed based on the Code of Practice and Performance Standards for Forensic Pathology in New South Wales
• Local protocols are in place in all hospitals and facilities likely to be required to assist in the management of Coroners’ cases
• Ensure that all staff who may be appointed as appropriate medical investigators by local Coroners are aware of this code of practice and the performance standards
• Medical Officers are appropriately credentialled to perform the various types of autopsies listed in the document

REVISION HISTORY

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1 BACKGROUND

1.1 Why a Code of Practice and Performance Standards?

The conduct of forensic pathology in the context of the Coroner justice system has a significant impact on the lives and wellbeing of many individuals. It is important that health professionals directed to perform duties by the Coroner remember that they are registered health professionals first. In the case of medical practitioners, they must abide by the Medical Board of Australia’s Good Medical Practice: A Code of Conduct for Doctors in Australia.

The Code of Practice and Performance Standards for Forensic Pathology in NSW has been developed for the use of all pathologists or other practitioners who are asked to perform post-mortem examinations on behalf of the Coroners in NSW. Post-mortem examinations include external examination of the body after death, collection of samples from the deceased and autopsy of the deceased.

Importantly, the practice of medicine regarding the deceased should be performed with the same care and attention that is afforded to the living.

Generally, only appointed Coronial Medical Officers (CMOs) and specialist Forensic Pathologists (or persons under their supervision) should perform post-mortem procedures (including ordering radiology or taking specimens for testing) associated with the Coroners Act 2009 unless this is first discussed with a specialist forensic pathology unit in each instance (Glebe or Newcastle). Practitioners should also carefully consider their competence to perform an external examination of the deceased and realise that this competence may vary depending on the circumstances of the death. In Section 2 a list of complex cases is detailed – these cases must always be discussed with a specialist forensic pathologist and should generally always be referred to a specialist forensic pathology facility.

The purpose of the document is to provide reasonable, practical guidelines for the practice of coronial post-mortem examinations and pathology in NSW. Standards such as these have been accepted by the Forensic Pathology Advisory Committee of the Royal College of Pathologists of Australasia and are in line with other similar codes of practice in place in other jurisdictions (see Section – Further Reading). It is intended that this Code of Practice will enable all coronial pathologists in NSW to demonstrate high standards of professional performance using valid and acceptable criteria.

This document is modified from Code of Practice and Performance Standards for Forensic and Coronial Pathologists prepared for the National Coronial Pathology Service of New Zealand by Prof. Ferris. It has evolved from the joint United Kingdom Home Office and Royal College of Pathologists’ Code of practice and performance standards for forensic pathologists, which was first published in November 2004 and can be accessed at the Royal College of Pathologists’ website at www.rcpath.org.

This code of practice is divided into sections, each dealing with a specific aspect of the activity of the pathologist. The document then expands, where necessary, on the way in which these standards should be maintained during delivery of the service. A number of appendices are attached detailing the procedures that should occur in specific types of deaths. New recruits to the profession who are seeking appointment to the Coronial Medical Officers’ list will be expected to display competencies derived from these standards.
1.2 Importance of the Code of Practice

This code of practice is intended to set out the essential requirements for the practice of forensic pathology in NSW.

All autopsies, investigations, reports and any other aspects relating to death investigations are to be conducted in accordance with the requirements of the Expert Witness Code of Conduct in Schedule 7 of the NSW Uniform Civil Procedure Rules 2005.

There may be circumstances where departure from these standards is appropriate. The reasons for this should be clearly documented and the practitioner should be able to justify their actions.

1.3 The duties and responsibilities of practitioners in forensic pathology

Among the duties and responsibilities of forensic and coronial pathologists, the following are considered particularly important.

- **Personal expertise:** Practitioners must keep up to date with the latest methods and information; for instance, by reading current forensic pathology literature and actively pursuing relevant continuing professional development (CPD) programmes.

- **Standards:** Practitioners will accept the use of agreed documented procedures (as detailed in the appendices or NSW Health policy directives) and participate in appropriate schemes of peer review and audit.

- **Integrity of evidence:** Practitioners must ensure that the integrity of evidence for police and coronial investigations is not compromised.

- **Reports and evidence:** Practitioners must present findings and evidence in a balanced and impartial manner and confine opinions to those based on personal skills and experience. Work of other experts in the field must be referred to where appropriate.

- **NSW’s coronial System:** Practitioners will be familiar with the NSW Coroners system

- **Service provision:** Practitioners will address and, where possible, meet the needs of Coroners and police through timely and effective communication with Coroners, police, legal professionals and other people involved in the investigative process.

**Acknowledgments:**

This document has been modified and adapted for New South Wales from a document prepared by:

James A.J. (Rex) Ferris, M.D., F.R.C.Path., F.F.Path.(I), D.M.J.(Path) Professor Emeritus of Forensic Pathology National Adviser, Coronial Pathology Service Ministry of Justice, with the knowledge and consent of the author and by Forensic Pathology Fellows of the Royal College of Pathologists of Australasia.
2 PROFESSIONAL STANDARDS IN CORONIAL AND FORENSIC PATHOLOGY

2.1 Introduction

The responsibilities of practitioners in respect of all aspects of their work – including audit, clinical governance, quality assurance, continuing professional development, revalidation and research – are the same as those of any registered health professional. However, those providing advice to the Coroner also have responsibilities to the court, including the need to offer impartial evidence – the integrity of which is not compromised – and the need to present such evidence in a manner that is acceptable to others involved in the court process. The coronial pathologist’s primary duty is to the Coroner and the Court. The coronial pathologist also has ethical responsibilities to the deceased.

Delegation of coronial autopsy cases to pathology registrars, or other individuals in training, requires close supervision by the forensic pathologist. Distance supervision is generally not acceptable and all such autopsy reports must be co-signed by the trainee and the supervising pathologist. Distance supervision may occur in exceptional circumstances and must be authorised by the Chief Forensic Pathologist in the relevant Hub.

The local Forensic Pathology service provider and the RCPA share responsibility for setting the standards that underpin high quality in pathology services. Practitioners must ensure that the service they provide is of a high quality and is conducted in accordance with a service level that demonstrates a commitment to quality, transparency and accountability. It is recognised that not all deaths occur in circumstances where all the steps of this process are required, but the absence of a step does not constitute an argument for ignoring the principles inherent within this code of practice.

The standards set out in this code are primarily for the investigation of suspicious deaths and homicides. However, although the general principles and standards can be applied to the investigation of all coronial cases, the extent to which this code of practice can be applied will depend on the nature of the case and the expectations of the Coroner and the police. In suspicious and criminal cases, these standards must be applied by Coronial Medical Officers, Forensic Pathologists and their trainees, regardless of the party instructing that individual.

In all cases, all pathologists should consider and communicate all reasonable explanations for the death regardless of apparent guilt or innocence of an accused person. These explanations must be brought to the attention of the Coroner. All autopsies, investigations, reports and any other aspects relating to death investigations are to be conducted in accordance with the requirements of the Expert Witness Code of Conduct in Schedule 7 of the NSW Uniform Civil Procedure Rules 2005.

2.2 The Code of Practice

This code of practice sets out what is expected of the practitioner when he or she is performing each step in the process of investigation of suspicious deaths, from the initial contact with the police or the Coroner regarding that death, to preparing the post-mortem report and presenting the evidence relating to the death.

The code of practice provides a framework within which a clinical audit and performance review can be carried out to assure the quality of performance of individual coronial pathologists, as well as to facilitate the collection of evidence for the revalidation process.
2.3 Cultural issues

All persons handling dead bodies, performing post-mortem examinations and handling tissue samples derived from such examinations should be sensitive to the cultural and religious expectations of the multicultural and multiethnic society of Australia. In all circumstances, practitioners should consider the direction in the Coroners Act that the person conducting the examination is to endeavour to use the least invasive procedures that are appropriate in the circumstances.

The practice of autopsy and retention of organs may go against the cultural and religious beliefs of members of the community, nevertheless, the Coroner may direct that an examination should be performed that is adequate to ensure that the true cause and circumstance of the death is revealed.

From time to time, requests are made to have the autopsy performed as soon as possible after death so that the body can be released to the family in a timely fashion.

Any retention of tissue samples must be authorised by the Coroner.

Unless the Coroner authorises otherwise, all organs should be returned to the body once the post-mortem medical examination is complete; there should be a prearranged process for arranging organ retention, examination and disposal or return of the retained organs between the Coroner, the pathologist and mortuary staff.

2.4 Referral of complex cases

Complex cases must be discussed with a Specialist Forensic Pathologist and will usually be referred to the appropriate Department of Forensic Medicine. Such cases include:

- All homicides and suspicious deaths
- Deaths requiring attendance by police at the autopsy
- All deaths in custody, or police action-related deaths.
- High profile deaths or deaths which are a matter of public interest
- Cases with identification issues
- Skeletal remains
- Accidents involving aviation, marine transport, trains and buses
- Multiple-death incidents and mass fatalities
- Any case requiring disaster victim identification procedures
- Workplace-related deaths
- Diving and scuba-related deaths
- Sudden unexpected infant deaths (see PD2008_070) and deaths of children under the age of 15 years
- Maternal deaths
- Infectious deaths requiring specific protocols (eg HIV, active tuberculosis, Creutzfeldt–Jakob disease)
- Deaths where the person died in circumstances where the person’s death was not the reasonably expected outcome of a health related procedure carried out in relation to that person
- Deaths of foreign nationals or tourists
- Any death outside the practitioner’s normal scope of practice
2.5 Timeliness of autopsy

In many cases there is a compelling reason to perform an autopsy as soon as practicable after the body is available. Ideally, the following cases should be performed within 24 hours of admission to the mortuary:

- Sudden unexpected death in infancy
- Maternal Death
- Deaths related to SCUBA accidents
- Homicides – where evidence may be obtained relevant to the investigation
- Deaths during police operations

2.6 Mortuary facilities

Pathologists should be satisfied that the facilities are appropriate for the task at hand and that the facilities comply with a safe working environment, including the prevention of infection in the mortuary and post-mortem room.

If a pathologist is not satisfied with any aspect of a mortuary, he or she should make these concerns known to the relevant facility manager.

2.7 Peer review

Peer review and audit are important for all practitioners. Coronial Medical Officers and Forensic Pathologists should regularly consult and discuss their cases with forensic colleagues and have arrangements in place so that this can be done.

Some cases – for instance homicides, infant deaths and deaths in custody – should be peer reviewed before a final report is released to the Coroner and the police. The value of review by peers cannot be overstressed and will be referred to throughout this document.

Documents have been developed in both Departments of Forensic Medicine (DOFM) that can be used to check critical conclusions. These should be used by all practitioners.

Coronial Medical Officers and Forensic Pathologists must not work in isolation from colleagues, either within the discipline of forensic pathology or from other clinical disciplines.

2.8 Keeping up to date

Practitioners should have ready access to a comprehensive medical library, including appropriate journals. It is expected that they will keep up to date with developments in medical practice and must be able to advise the Coroner, on current literature. Weekly education sessions are available at both DOFMs (Glebe and Newcastle).

2.9 Assistance from other specialists

Practitioners must have in place adequate arrangements for consulting with experts in other medical and scientific specialities. These experts may be asked to assist or advise in appropriate cases.

Practitioners are expected to have full and easy access to departments of all other branches of pathology, including access to departments of radiology and to forensic science services. They should have adequate provision of modern information technology, including Internet access.

In cases requiring the referral of samples and exhibits to other specialists, the practitioner will need to ensure the security and continuity of the evidence involved as well as coronial authority for the testing. This authority (consent) should be confirmed in writing.
2.10 Record-keeping

Maintenance of adequate records is vital. Full notes of briefings and conferences must be kept, as well as all work carried out, tests performed and results obtained. Documentation of special tests, photography and radiology must be undertaken. Practitioners must ensure that their records are held securely and are not subject to unauthorised access.

Pathologists’ records constitute relevant material and may need to be produced to court as part of the evidence procedure. Records must be properly indexed and archived in secure storage.

There may be occasions, such as at the scene of discovery of a body or during an autopsy, when the pathologist may record observations; for example on tape or in written notes. In such circumstances it would be prudent to retain original items.

If observations are dictated, then the standard will require the retention of transcripts of these recordings (or secure storage of the recordings themselves). It is important for the pathologist to remember that all recorded material is potentially discoverable to other parties involved in a legal action.

2.11 Departure from standards

Where the pathologist becomes aware of a departure from these standards by themselves then an immediate effort should be made to correct it.

Where a pathologist becomes aware of a departure from these standards by another pathologist, then that pathologist should be notified so that immediate corrective action can be taken. If, however, there is a significant departure that cannot be immediately rectified, that deficiency should be brought to the attention of the pathologist’s instructing party.

Where the pathologist becomes aware of repeated unreasonable departures from these performance standards, he or she should bring such concerns to the attention of forensic pathology management and the Coroner. Consideration should also be given to the mandatory reporting obligations of medical practitioners under the *Health Practitioner Regulation National Law (NSW) (2012)*.
3 SUSPICIOUS DEATHS: INITIAL CONTACT WITH THE PATHOLOGIST

3.1 Standard

The on call Forensic Pathologist/CMO must be readily accessible to the police. The senior investigating officer and the practitioner will determine:

- that the Coroner will be notified of the death and will authorise the post-mortem medical examination;
- the nature of the case and, if known, issues raised by it; and
- the requirement for the pathologist’s attendance at the scene of discovery of the body.

If it is not possible for the on call Forensic pathologist to attend the scene of death, it will be his or her responsibility to discuss alternative arrangements with the police, the Coroner and the local coronial pathologist.

The pathologist must fully document the discussions of these issues, with relevant dates and times.

3.2 Code of Practice

It is the responsibility of the pathologist to ensure that when on call he or she can be contacted at all times. Adequate arrangements should be in place for appropriate alternative pathologists to be available to provide cover during off-duty and leave periods.

Maintenance of these arrangements is the responsibility of the local Forensic Pathology service provider. Those involved in the roster system should give adequate advanced notice to the Coroner and police of any change in arrangements.

Forensic Pathologists are also responsible for ensuring contact details are available to the police and Coroners. This should include all relevant telephone, mobile and fax numbers. Even when not on duty it is helpful, if possible, for contact details to be made available in case there is some emergency, such as a mass disaster that requires the attendance of as many pathologists as possible.

Call-out arrangements vary around NSW. Either the Duty Operations Inspector (DOI), the senior investigating officer or the senior crime scene or forensic services officer will contact the Forensic Pathologist.

There should be no unreasonable delay in responding to a call, particularly if examination of the body at the scene is required. The Coroner’s permission must be sought prior to any invasive procedure being performed on the deceased at the scene, including, for example, the taking of a body temperature. Police must be made aware of the time required to travel to a particular incident. This will vary from situation to situation, depending on the distances involved. On occasion, the pathologist can reasonably expect police to make arrangements for travel, for example, to avoid the pathologist having to drive long distances.

In some cases it may be appropriate for the Forensic Pathologist to make arrangements with the police for the local coronial pathologist to attend the death scene on behalf of the Forensic Pathologist and report the findings to the Forensic Pathologist for further consideration. Digital imaging may also be used as an alternative to scene attendance by negotiation with the relevant crime scene officer at the death scene.
4 THE BRIEFING

4.1 Standard

At the pre-investigative briefing, the pathologist will liaise with the senior investigating officer and any other experts present on:

- The need for the Coroner to authorise any examination of the body at the scene and to perform investigations at the scene
- the best plan of approach to the examination of the scene and the body; and
- what evidential issues are raised by the circumstances of death and how these issues are best approached;
- what risks of contamination of evidence are posed by the circumstances of the case and what measures are required to prevent such contamination;
- health and safety issues, if necessary, in relation to the scene of discovery of the body and personnel involved in the examination;
- the best location to perform the post-mortem examination and, if possible, an approximate time of arrival at that location.

The pathologist should make notes of this briefing.

4.2 Code of Practice

The pathologist should ensure that all available details of the circumstances of death have been provided. He or she should be briefed by the senior investigating officer or other officer delegated to this task.

This briefing should be carried out at the first available opportunity and should be done before the pathologist carries out any detailed examination of the body or the scene of the incident. The briefing should include any version of the circumstances of death given by witnesses, together with any possible explanations for the death advanced by the witnesses.

Adequate and appropriate briefing is essential if the pathologist is to obtain the maximum information from his examination. The act of carrying out the post-mortem medical examination will alter the condition of various parts of the body. If the pathologist does not learn of possible explanations for his findings until after the examination is completed, there is a risk that the best evidence to confirm or contradict the explanations for the death given by witnesses may not be available.

The pathologist must not assume that any one of the explanations that have been advanced for the death is necessarily correct. However, he or she will in due course consider any such explanations in relation to the scene and post-mortem findings in order to come to proper, reasoned conclusions.

It is important that the pathologist records in sufficient detail any briefing given, including the date and time, to enable the pathologist or some other individual to recall and understand any matter that may have been considered when conducting the examination. The absolute importance of making and keeping proper notes is stressed throughout this code of practice.
5 SCENE OF DISCOVERY OF THE BODY

5.1 Standard

The Forensic Pathologist will:

- Have permission from the Coroner to examine the body at the scene, and if necessary authorisation to perform investigations at the scene;
- agree the approach to the scene after discussion with the senior investigating officer and other personnel, including Forensic staff;
- enter the scene only by the agreed route of access, wearing the protective clothing agreed as appropriate for the circumstances in the case;
- determine whether any special techniques or procedures may be needed during the examination of the scene and the body;
- determine what specimen recovery will take place at the scene and in due course take, supervise or assist in the taking of, such samples;
- ensure the protection of any trace evidence that is not to be collected prior to removal of the body from the scene;
- determine the route of removal of the body from the scene and if necessary supervise the removal of the body by the mortuary ambulance service;
- bring to the attention of the senior investigating officer, and be prepared to give advice on, any health or safety issues relating to the scene and the body, where this lies within the pathologist’s area of expertise;
- record the data that may assist in attempts to determine the time of death;
- ensure that if it is necessary to manipulate the body during the examination at the scene, such manipulation is adequately recorded;
- ensure that as soon as possible, within the needs of the examination and preservation of the scene, the body is removed to a place of proper storage in order to preserve the integrity of the information to be derived from the post-mortem medical examination of the body.

The pathologist must record relevant details of the scene and the body and must document his or her own actions and those of others that may be significant to the pathologist’s examination.

5.2 Code of Practice

5.2.1 Scene management

With advances in resuscitation, bodies are often immediately and quite properly removed from the scene of discovery and transferred to a local hospital. However, when a body is still in situ, careful consideration must be given to the need for the pathologist to attend the scene. Even when a body has been removed and the autopsy already carried out, examination of the scene may provide useful evidence. Permission from the Coroner must be sought to examine the body at the scene and to perform investigations at the scene.

Because of the advances in forensic scientific examination of crime scenes, it is important that the forensic pathologist, forensic scientists and the crime scene examiners coordinate their examinations and
ensure that appropriate priorities are determined. This should be coordinated by a senior Police officer in conjunction with the senior investigating officer. If a forensic pathologist does not attend the scene, then it is important that the scene should be adequately photographed with video-recordings or other image techniques. These may offer further help in briefing the forensic pathologist.

5.2.2 Action at the scene

Before arriving at the scene, or on arrival there, the pathologist should be briefed by the senior investigating officer. Ideally, this briefing should involve other experts appropriate to the nature of the scene e.g. the coroner, crime scene officers and staff from workplace safety. The pathologist should record the facts given to him or her at this briefing.

The crime scene will be under the control of the crime scene manager or the senior investigating officer. The pathologist’s approach to the body and the examination of other aspects of the scene should be undertaken only after consultation with this officer and other scenes-of crime experts who are present. Such discussions must include routes of access to the scene and the prevention of contamination.

Where there has been no briefing before the scene visit, all the issues described in Chapter 4 “The briefing” will need to be considered before entering the scene. Attendance at the scene itself may require reconsideration of decisions made at the previous briefing.

5.2.3 Importance of notes

The pathologist should record his or her actions and observations at the scene using comprehensive written or taped notes, including the use of sketch diagrams or photographs where appropriate. These records will be needed during the preparation of a subsequent report and when giving evidence in court. They are discoverable.

5.2.4 Photography

The pathologist should advise the police photographer of what photographs need to be taken of the body and, if this has already happened, consideration should be given to the need for additional photographs. Generally any photos required should be requested of the Crime Scene Officer and not taken by the pathologist.

5.2.5 Position of the body

The position of the body and that of each of the limbs and of the head should be recorded, together with the relationship of the body to adjacent objects, such as furniture and other articles. The state of clothing should also be noted. There should be no movement of the body before photographs have been taken, except as necessary for the confirmation of life extinct or for resuscitation purposes.

Trace evidence and patterns on clothing e.g. blood spatter may be of forensic importance and should be preserved appropriately as such evidence may be lost if transported on the body inside the body bag.

5.2.6 Assessment of the time of death

It is not usually possible for a forensic or coronial pathologist to give a definitive time of death.

Coronial pathologists must be aware of current methods used for the determination of time since death and the limitation of such methods. Except where the body has been exposed to fire or is decomposed or skeletal, recording of the ambient temperature may be made. If possible, the deep temperature of the body should be taken. However, it is recognised that the latter procedure is invasive and may interfere with the proper collection of other potentially more important forensic evidence at the scene. A rectal swab should be routinely taken prior to measuring the rectal temperature looking for evidence of sexual assault. The pathologist must be able to justify not taking body temperature if the scene was attended. If
for some reason it is not practical to measure the body temperature at the scene, it may be recorded as soon as practical upon arrival of the body at the mortuary. The degree, location and fixation of rigor mortis and hypostasis should be noted.

5.2.7 Other aspects of scene examination

Detailed examination of the scene of discovery of the body is usually undertaken by crime scene police and forensic scientists. However, the forensic pathologist may be required to inspect some aspects of the scene and its relationship to the body and note any findings. It is important to establish which agency is responsible for each examination prior to any examination by discussion with the senior investigating officer and the specialist scene-of-crime examiners.

It may be appropriate for the forensic pathologist and a forensic scientist to jointly examine the scene, including features such as the distribution and appearance of any bloodstains. Although the forensic scientist’s report will contain detailed comment on such matters, the pathologist should be directly responsible for giving an opinion on the nature and possible cause of wounds that may be the source of the blood and bloodstains.

The pathologist may need to take into account the distribution of blood from any injuries when reconstructing the way in which injuries are likely to have been inflicted.

5.2.8 Involvement of other specialists

Occasionally, it may be appropriate to seek advice from other specialists, such as forensic entomologists or anthropologists. The pathologist must determine whether the circumstances of the incident indicate the need for such specialist advice, and must make the senior investigating officer aware of the need.

5.2.9 Prevention of contamination at the scene

Only the minimum number of personnel required for efficient and safe examination of the scene should enter the scene. Where it is likely that minute traces of evidence may be important, for example in the use of low copy number DNA, consideration should be given to the priority of the forensic pathologist’s role in terms of entering the scene and medical assessment of the body. Appropriate protective clothing should be worn and changes of gloves may be necessary during the investigation, particularly if exhibits are taken during the examination.

5.2.10 Taking specimens at the scene

It is essential that no specimens are taken from the body until there has been consultation between the pathologist, the investigating officers and forensic scientists, if present. Where the taking of certain samples at the death scene is not considered necessary, these should be omitted only after obtaining the consent of the investigating officer. Where appropriate, arrangements should be made for the specimens to be taken at the subsequent post-mortem examination.

5.2.11 Removal of the body

When a scene is being assessed, the pathologist will often supervise the packaging and subsequent removal of the body. If trace evidence has not been collected at the scene, paper bags may be placed over the hands and secured before the body is removed. If the head is to be similarly placed in a bag, it must be remembered that any open head wound is likely to shed blood into the bag during transit. This may obscure details such as the direction of dried bloodstains and render difficult the collection of trace evidence. It is often advisable to examine the head, and document and photograph such evidence, at the scene.
Where the Forensic Pathologist attends the scene he or she should ensure that the body bag is sealed to prevent tampering with the body.

On arrival at the autopsy room, the body should remain undisturbed in its wrapping or body bag until the pathologist arrives to undertake the examination, unless any different action has previously been agreed with the senior investigating officer or officer-in-charge of the body.

If there is a delay between the removal of the body to the mortuary and the subsequent post-mortem examination, it is important that the body should be secured in a proper storage locker.
6 THE AUTOPSY

6.1 Standard

At the mortuary the pathologist will:

- identify and ensure that the body is that for which the pathologist has authorisation from the Coroner to perform an autopsy;
- ensure, if trace evidence was not taken at the scene, that as far as practicable the body is not contaminated by any fixture, fitting or person at the mortuary;
- take, or supervise the taking of, any necessary trace evidence not taken at the scene;
- ensure that any manipulation of clothing, once removed from the body, takes place over the body wrapping so that any evidence shed from the clothing will not be lost;
- ensure, if possible within the context of the investigation, that the dignity of the deceased and the ethical and cultural issues relating to the deceased and the family are accommodated;
- be able to justify all examinations, having regard to the context of the case;
- remember that while a criminal investigation must never be compromised, the needs of any one party must not be accommodated to the detriment of other parties;
- note any significant features of the body that reveal something out of the ordinary, whether or not they appear immediately relevant to the cause of death;
- note any parts of the body that have been examined and no abnormality found, because negative findings may be significant;
- ensure that where findings of apparent significance can be demonstrated visually, photographs are taken so that others can see for themselves at a later date;
- retain any material relevant to the cause of death that may assist in the resolution of issues that may arise during the investigation of the death, including those that can be anticipated at a subsequent investigation or trial; and ensure that all exhibit labels that are necessary to ensure the chain of custody of samples removed for evidential purposes are documented at the time by the officer-in-charge of the body.

The pathologist must record full details of the autopsy and document his or her own actions and those of others that may be significant to the examination.

Where a notifiable disease is recognised, including certain infectious diseases, possible adverse event following immunisation or cancer as specified in the NSW Public Health Act (2010) or its successor it must be notified to the local public health unit.

6.2 Code of Practice

6.2.1 Approach to the autopsy

Having equipped him or herself as far as possible with information about the likely issues to be resolved, the pathologist will be ready to embark upon the actual examination. It is important to note any significant features of the body where the pathologist’s findings reveal something out of the ordinary, whether or not this appears immediately relevant to the cause of death. The pathologist must also carefully record the fact that he or she has examined parts of the body and found no abnormality, because a negative finding may turn out to be as significant as a positive finding.

Techniques employed during the dissection, or during any subsequent investigation, should as far as practicable be accepted and well-established procedures. The pathologist must be able to explain the use
of any novel or unorthodox technique to colleagues and to the Coroner. Because post-mortem medical examination of a body and special dissection techniques are essential roles of a forensic pathologist, it is expected of all forensic pathologists to maintain these skills by regular practice.

Wherever possible, and particularly where it is relevant to the investigation, the forensic pathologist should have access to the medical history of the deceased before the autopsy is commenced. Where such records are not forthcoming, the pathologist will need to decide whether it would be sensible for the autopsy to be postponed until the information becomes available.

It is important to consider whether special investigations are warranted – consult the appendices for specific recommendations for autopsy practice in particular suspected types of death.

The autopsy should be conducted in a timely fashion. Certain cases – particularly SUDI, maternal deaths, SCUBA deaths, homicides (particularly where evidence may be obtained pertinent to the investigation) and deaths during police operations should be done as soon as possible – usually within 24 hours of admission to the mortuary.

6.2.2 General considerations

Autopsies should only be conducted in mortuaries that have adequate facilities and safety procedures. Where mortuary facilities are deemed to be inadequate, the pathologist should consider whether the examination should be performed at that location and, if necessary, discuss the matter with the Forensic Pathologist and the Coroner.

The location should have modern autopsy equipment, including accurate weighing apparatus for organs and for the whole body. There should be access to equipment for radiological examination and to a radiologist’s opinion.

The examination should not normally be conducted without the assistance of skilled, trained mortuary technical staff. The pathologist should brief the mortuary technician on the nature of the case and his or her tasks. An experienced technician can assist with the dissection at the discretion of the pathologist, but must be under the control and supervision of the pathologist at all times. The pathologist must remain in the mortuary at all times during the post-mortem medical examination.

In all cases of homicide or suspicious death, the pathologist is responsible for the entire post-mortem medical examination and he or she should perform dissection of forensic significance.

Where identity has been established, continuity of identity from the scene of discovery should be carried out at the start of the examination and the formal identity should be confirmed by the pathologist. If identity has not been established it should be identified by reference to where and when it was found, and formal identification by visual identification, dental comparison, fingerprints or DNA should be performed. The individual identifying the body to the pathologist should be recorded and mentioned in the report.

The autopsy must be carried out in a manner that is consistent with medical ethics and that respects the dignity of the deceased. In suspicious deaths, any viewings should be conducted in the presence of the police officer charged with responsibility for the continuity of the body. In suspected homicides, the senior investigating officer or officer-in-charge of the body will normally be present throughout the autopsy so that he or she can fully appreciate the autopsy findings and answer any questions that may arise about the circumstances of the case. Scenes-of crime investigators and forensic scientists should also be present where appropriate. It is essential that all personnel present in the autopsy suite are subject to full precautions to protect them from infective hazards and to avoid any contamination of the body or clothing. The number of individuals in the autopsy room should be kept to a minimum.
A written record of all those present during the post-mortem examination should be kept, with each individual present in the mortuary suite signing their name and giving information about how they may be contacted, such as a telephone number. See Appendix 1 for an example of an attendance sheet.

6.2.3 Involvement of other specialists

The pathologist must consider whether he or she has the appropriate expertise to perform an autopsy in the circumstances of the case and should request the attendance of an appropriate expert if necessary. The pathologist must cooperate in an appropriate manner with such experts.

If the investigation of the case requires the assistance of other specialists, such as a paediatric pathologist or neuropathologist, it is the responsibility of the pathologist to make such appropriate recommendations to the senior investigating officer. The pathologist should seek advice from the expert to determine what material may be required for later examination and interpretation, and to ensure that this is recorded and/or preserved in an appropriate manner in accordance with the general protocols relating to retention of tissues.

6.2.4 Photography

It is expected the pathologist will ensure that adequate photographs are taken of the whole body and of all wounds or other abnormal features before commencement of dissection. Photography in the mortuary should be carried out under the supervision of the pathologist or by the pathologist.

Pathologists should generally not take photographs at the scene (instead they should liaise with the Crime Scene Officer), but should do so in the mortuary and the report must indicate that such photographs exist. These photographs must be available to be disclosed to the defence or other interested parties as required.

Findings of apparent significance that can be demonstrated visually should normally be photographed so that others will be in a position to see for themselves at a later date. It is particularly important to record the condition of the body if the examination will itself interfere with the findings and therefore prevent anyone else from assessing the significance of these findings.

6.2.5 Radiology

Radiological examination should be part of the examination of all cases of suspected non-accidental injury in children, any SUDI case, deaths relating to SCUBA diving and in all deaths involving the use of firearms or explosives. It can also be of considerable assistance in the examination of badly burnt or decomposed bodies and may be appropriate in other circumstances. The pathologist will be responsible for advising on the need for such examinations and for seeking the assistance of a consultant radiologist where necessary.

6.2.6 Autopsy notes

Comprehensive contemporaneous notes are essential and should be taken of every procedure undertaken. They may be written or dictated. Where appropriate, notes should be accompanied by diagrams or photographs. Notes must include the time, date and place of autopsy and the names of all personnel present, with an indication of the role of each person in the mortuary. The notes or tapes should be retained as described above (see Sections 4 “The briefing” and 5.2.3 “Importance of notes”). The notes must be retained and may be required for peer review, audit or disclosure during criminal proceedings.
6.2.7 Removal of clothing

Any clothing on the body must be removed carefully, preferably without cutting, and placed in appropriate bags with due care to avoid contamination. This should be done after trace evidence has been removed from the rest of the body, particularly the hands unless they are bagged. Although detailed examination of the clothing is a matter for the forensic scientist, the pathologist should check it for damage such as cuts or bullet holes, which may influence the conclusions to be drawn from the examination of the body.

Any manipulation of the clothing should take place over the wrapping material so that any shed evidence is not lost. In some instances, tapings should be taken from the surface of the clothing before its removal. This is usually done by a forensic scientist, but may be done by other trained individuals under the supervision of the pathologist.

It is often important for serial photographs to be taken as each garment is removed. Adequate notes must be made of the procedure and the findings.

6.2.8 Collection, handling and preserving trace evidence from the body

Almost all cases of trauma or unnatural death – be they murder, motor vehicle accident or industrial accident – may become the subject of either a criminal or civil investigation. Because of the sophistication and extreme sensitivity of modern forensic science techniques, any material related to such cases that may be required for examination in a forensic science laboratory must be handled in such a way that it is free from contamination.

The purpose of these forensic examinations may be to determine if a known and unknown sample had a common origin. It becomes the responsibility of any individual who has possession of these samples to ensure that they are properly identified, preserved and packaged for transportation. Failure to do this may result in loss or deterioration of the exhibit. An inability to prove continuity of the sample may result in its inadmissibility in court.

The normal packaging, labelling and transportation of tissue and body fluid samples in a hospital environment will meet most of these requirements. However, problems tend to arise in connection with clothing and other non-biological samples.

Every item recovered must be properly packaged and labelled with the following information.

- What the item is. For example, blood, urine, bullet, etc.
- Where it was taken from. For example “bullet from left chest cavity”.
- When it was taken. For example “8.30 p.m., April 1, 2005”.
- Who took it: “Dr. J Fussy, Forensic Pathologist”.

The initials or signatures of all persons who have had custody of each item should be placed on the label. When samples are handed over to a police officer or investigator a record of the name of the person to whom the exhibits are handed must be maintained by the autopsy facility, together with the date and time that the exhibits were handed over. Records of all the procedures involving the handling of autopsy exhibits in relation to any particular case should be retained as a permanent record and also incorporated into the autopsy report (see below).

Each item must be separately identified in such a way that this marking does not interfere with or destroy the evidence to be examined. If it is not possible to mark the items directly, they must be placed in appropriate containers and each container labelled. Every effort must be made to preserve the object (such as clothing) in the condition in which it was found. To prevent decomposition, items that are stained with blood and other body fluids need special handling. Wherever possible, they should be air dried prior
to packaging, otherwise they should be packaged in paper containers and transferred as soon as possible to a special storage area. Blood, body fluids and internal organ samples should be refrigerated or sent immediately to the laboratory for testing and storage.

The pathologist must ensure, if all the samples have not been taken at the scene, that there is no opportunity for contamination of the body from any fixture, fitting or person in the mortuary. Samples should be taken after discussion with the senior investigating officer and appropriate forensic experts. Only where discussion indicates that samples are not necessary should they be omitted. Such discussions should be documented.

Although the specific number and types of samples collected will vary from case to case, the following is a list of samples that may be taken at post-mortem. In some cases, if the autopsy is not carried out until after a period in hospital, the collection of some or all these specimens may be of limited value.

The pathologist should decide from where and by whom the samples should be taken. The taking of samples from the following areas should be considered:

a) tapings from exposed body surfaces and uppermost surfaces of clothing (where that clothing is such that it is considered likely that trace evidence will be shed on manipulation). If clothing is not to be cut away, the manipulation of the body required to remove clothing may dislodge or contaminate trace evidence

b) combings of head hair, beard and moustache hair and pubic hair

c) plucked hairs from the above sites, each sample being representative of the range of hairs present at those sites

d) where objective evidence of chronic drug use is relevant to the case, a pencil thickness of head hair, plucked from the occipital scalp and wrapped in foil

e) a swab or swabs from the mouth and teeth

f) tapings from the hands where any foreign material is recognised; tapings must be taken before fingernail scrapings or cuttings

g) scrapings from underneath the fingernails of each hand, or fingernail cuttings, using appropriate orange sticks or scissors. Sampling from hair and hands where the death may be related to firearms or explosives must be made using only a ‘Gunshot residues and explosives sampling kit’ approved by the relevant forensic science laboratory

h) swabs from any moist areas on the body surface where the possibility exists that such moist stains have arisen from a person other than the body. Where there is a possibility of sex-related crime, swabs will be taken from those areas considered most likely to be productive of semen or saliva (face, neck, nipples, and hands)

i) a swab or swabs from the perianal skin, taken before a swab or swabs from the anus

j) a swab or swabs from vulva and high and low vagina, taking care to avoid contamination of the latter from the initial swabbing of the former. These swabs must be taken after swabbing of the perianal skin and anus (to avoid leakage during the course of the vulval swabbing)

k) a swab or swabs of injuries that may have resulted from contact with another individual where the skin from that individual may have been shed, e.g. swabbing of the skin of the neck in postulated manual strangulation.

In each instance, appropriate control swabs must be taken.

### 6.2.9 Autopsy procedures

The pathologist should carefully consider whether a more limited examination than a full three-cavity autopsy may be appropriate. Such limited examinations may include external examination, external examination with radiology and/or toxicology, staged autopsy or an autopsy limited to one or more parts of the body. The Coroner’s Act directs that the pathologist should endeavour to use the least invasive procedure appropriate. The appendices should be consulted for types/circumstances of deaths that
usually require a particular type of examination. If there is any doubt the opinion of the Senior Forensic Pathologist at Glebe or Newcastle should be sought.

**Measurements**

SI measurements must be used.

**External examination**

The description of the body should include age, sex, height, weight, nutritional state, skin colour and special characteristics such as scars, tattoos, etc. Notes should also include the length, colour and distribution of hair and beard, the presence or absence of petechiae in the conjunctiva and the appearance and length of the fingernails.

If not already dealt with at the scene, rigor mortis should be systemically tested for in the neck and in the extremities, and the degree of rigidity noted.

Signs of treatment should be recorded. Medical devices should not be removed from the body before the post-mortem examination and the pathologist should endeavour to inform staff of this requirement if they are likely to handle the body.

**Examination of injuries**

All injuries must be described by shape, exact measurements, direction, edges and angles. The location of the injury relative to anatomic landmarks and, if appropriate, the height above the heel should be measured. In cases of multiple repetitive injuries, it may be appropriate to describe groups of injuries.

In the case of closed injuries, such as bruising, the colour should be noted. A local skin incision may be appropriate in the assessment of bruising.

Skin reflection may be necessary in some parts of the body, but unnecessarily dissections and destructive examinations should be avoided. Any dissection that does take place must be of such a type that the body can be adequately reconstructed.

All dissections carried out at the time of autopsy must be justified in the context of the case. There should be a low threshold for the examination of subcutaneous tissues of the trunk and upper limbs for evidence of bruising, particularly in dark-skinned individuals where bruising may not be apparent at the skin surface.

Where it is deemed important to examine the facial structures and to dissect the face from the underlying facial skeleton, this whole dissection must be performed skilfully and carefully so that the face can be replaced with little significant distortion (see special dissection techniques listed in Appendix 23).

**6.2.10 Internal examination**

Pathologists should adhere to the guidelines on autopsy practice issued by the Royal College of Pathologists of Australasia. The standard of internal autopsy dissection must be appropriately comprehensive. In addition to the forensic aspects of the examination, careful attention must be paid to any features that may be relevant to natural disease or medical intervention.

Incisions should be appropriate in relation to the nature of the case.

The state of body cavities should be described and the amount of fluid or blood in each cavity should be measured.

All organs must be dissected and accurately and adequately described with their weights. Other measurements should be recorded as appropriate. Attention should be paid to the contents of the stomach and bladder. The external genitalia, and vagina or testicles should be specifically examined.
Autopsy standards for different types of cases are attached as appendices to this code of practice.

### 6.3 Collection of internal specimens at autopsy

The pathologist must ensure that all necessary samples are taken for toxicology and are appropriately preserved. It may be necessary to discuss with toxicologists what specimens may be required and how they should be handled. Blood for toxicology should be taken from a peripheral vein where possible. Other sites may be sampled as relevant. The sites of collection of blood samples must be noted. Where possible, blood, serum and vitreous humour should be stored – either at the facility where the post-mortem has occurred, or at a Department of Forensic Medicine.

Control samples, for example for DNA examination, should be collected and retained according to the instructions given by the forensic scientists.

In addition, the pathologist must consider whether other types of microscopic or laboratory examination will be necessary and whether samples for these purposes should be taken at autopsy. This may include the taking of specimens for microbiology, cases where molecular biology may be of assistance or other tests appropriate to the case history. In some circumstances the pathologist will decide that tissues or organs need to be retained for later examination. In such instances he or she must make appropriate arrangements, including any necessary discussion and notification to the Coroner responsible for the body.

#### 6.3.1 Post-mortem histology

Histological examination of the major organs should be made by the pathologist in all deaths. Histology should be taken of all significant macroscopic pathological abnormalities. Routine histology should also be taken of the left ventricle, right ventricle, coronary arteries, liver, lungs kidneys and brain (Langlois 2006). It is of value in confirming, evaluating and sometimes revising the course of natural disease processes that may have contributed to the cause of death.

Other samples should be taken for histological examination depending on the circumstances of the case; for example, for the purposes of ageing injuries. The reasons behind any decision not to undertake a histological examination must be adequately recorded so that the pathologist may be in a position to explain this decision if required.

Representative samples of injuries should be taken and each section labelled in such a way that the injury location can be identified. Although the precise timing of injuries from their microscopic changes may not be possible, significant information may be obtained, particularly in the identification of separate episodes of injury.

Any special issues of diagnosis or interpretation should be referred to other experts for their opinions. In some cases, such as the interpretation of fractures in cases of child abuse, the microscope sections and, if necessary, the tissue blocks should be referred for expert second opinion.

#### 6.3.2 Health and safety issues

The pathologist has a role in advising on health and safety in the post-mortem room. The pathologist is expected to set an example in matters of health and safety. All professionals should take care of their own health and safety and should advise colleagues if they are inadvertently (or purposefully) engaging in practices that may endanger their health. Good mortuary health and safety will not only serve to protect the participants in the autopsy procedures, but will also go a long way to protect the continuity and integrity of trace evidence and autopsy exhibits.
All those involved will be expected to take very serious account of the pathologist’s directions, particularly when dealing with a recognised or potential high-risk case. Any autopsy room used for the examination should reach accepted safety standards and should be staffed by properly trained mortuary technicians.

Universal precautions should be used, as the possibility of the presence of an infectious disease cannot always be excluded on history and external examination. Where there is a known history of infectious disease or a high suspicion that one may be present special precautions may need to be taken (eg tuberculosis). The pathologist should take careful account of local standard operating procedures.

6.3.3 Retention of material after autopsy

Unnecessary or ill-considered retention of material removed at autopsy has caused considerable distress to bereaved relatives. The pathologist must carefully consider whether material needs to be retained and for what purpose.

Any retention of organs must be authorised by the Coroner.

As a general principle, any material obtained in the course of a criminal investigation that may be relevant to the investigation should be retained until the end of the criminal proceedings. Following the completion of any appeals procedures, this material may be offered to the family for appropriate disposal.

It is important that at the time of the post-mortem examination the pathologist documents whatever material is to be retained and informs the Coroner in writing, explaining who has been informed of the retention so that the Coroner can notify the next of kin. Retained materials must be kept in secure storage under suitable conditions and the location must be properly recorded and indexed in order to ensure easy access. It is important to list retained materials in the autopsy report and/or the case record.
## 7 PATHOLOGIST’S AUTOPSY REPORT

### 7.1 Standard

The pathologist will produce a formal report that will document:

- all the observations, both external and internal, made by the pathologist at the time of his or her examination;
- additional decisions and actions taken at the examination of the scene or the body that were considered appropriate to the investigation;
- any special investigations which were approved by the Coroner made either personally by the pathologist or following a submission to a laboratory for a report;
- any conclusions, and an explanation for those conclusions, relating to the manner and mechanism of death. Where unusual features have been identified but are concluded not to be relevant, the pathologist must explain why these findings have been discounted;
- the reasoning underlying why one explanation has been favoured in situations where findings are susceptible to alternative explanations;
- the reasoning that supports conclusions detailing all material drawn upon to support that reasoning, including reference to pertinent and current literature where appropriate; and
- all samples that have been retained by the pathologist, whether or not these have been assigned police exhibit references.

The pathologist should be able to discuss the case and consult with other forensic pathologists regarding the wording of the report. Where possible the pathologist should have in place a peer review procedure whereby another pathologist may scrutinise the report to ensure it conforms with the requirements given above.

If a peer review reveals significant disagreement and the differences cannot be resolved, they should be communicated to the Coroner.

The report will be produced as quickly as possible with regard to the complexity of the case and within an agreed timescale, depending on the investigations and expertise required. The pathologist may not need to wait for special investigation results from forensic science services because they may not directly affect the conclusions of the pathologist.

The pathologist will make the Coroner aware of a provisional timetable for the production of a report in complex cases, particularly in cases where there are issues that require detailed and extensive literature research and further investigation.

The pathologist will consider additional information revealed by investigations after the provision of a report and where necessary produce a supplementary report incorporating that information and drawing further conclusions.
7.2 Code of Practice

7.2.1 General comments

In general terms, the report or statement must be clearly laid out, section by section, in an easily read format.

1. Basic information relating to the nature of the case, the name of the deceased, the time and details concerning the post-mortem examination.

2. The history in the post-mortem report should reflect 1) the information supplied up to the time of post mortem medical examination and 2) information supplied following the post mortem medical examination. In some cases the information relating to the history may not be admissible as evidence since it may either be inaccurate and/or hearsay evidence. It is important to include the history because it indicates what information the pathologist has been given and may influence his or her conclusions drawn from the objective findings made during the post-mortem medical examination.

3. Scene examination.

4. External examination.

5. Internal examination.

6. Supplementary findings and additional investigations, including histology and x-ray findings.

7. Opinion and conclusions.

8. A list of samples retained and an explanation of how other samples and exhibits have been disposed of; for example, handed to the police or the exhibits officer.

9. A summary page identifying the principal pathological findings and the cause of death. Placing this section early in the report may assist the reader.

The essence of a post-mortem report from an expert witness is that it should be easily read and unambiguous. The report, and in particular the opinion or conclusions, must be intelligible and easily understood by non-medical people so that it is suitable for presentation in court, at an inquest or to the family. It should be clearly divided into sections, and subsections where necessary. The language should be as straightforward and simple as possible, while retaining complete accuracy and balance and being sufficiently detailed to allow other medical experts to fully comprehend the abnormality or injuries being described.

The report should compiled in accordance with the Uniform Civil Procedure Rules 2005 – Section 7, including mention of material available to the pathologist at the time of autopsy or when drawing conclusions in the report. This may include Police Records, ante-mortem pathology reports, medical records or reports from experts.

Decisions with serious legal implications may be based partly, or even solely, on the pathologist’s report, so it must be sufficiently detailed to allow these decisions to be made. In view of this, the report must be written in a fair and impartial manner and must take into account all the relevant issues of the case. The pathologist should remember that in some cases the jury may retire to the jury room with a copy of the report, which will be analysed by this non-expert group.

7.2.2 Report Cover sheet

The report cover sheet must set out the full name, age, etc., of the deceased, together with the date, time and place of the post-mortem examination. The pathologist’s name, qualifications and appointment must
be stated. In order to properly identify all the circumstances surrounding the autopsy, the report should include the names of:

- the person identifying the body to the pathologist;
- any senior police officers and/or other observers present; and
- the names of police photographers, scenes of crime officers and the officer-in-charge of the body.

7.2.3 History

The inclusion of a history in the post-mortem report has been discouraged by some Coroners and lawyers. Although it is recognised that the history is essentially hearsay evidence rather than a reflection of the pathologist’s own experience of the case, it is appropriate to document the history and circumstances of the death as reported to the pathologist.

7.2.4 The scene of death

The pathologist should record in the post-mortem report any visit that he or she made to the scene of death, noting the date and time of arrival at the scene, the location, and a general description of the position of the body.

The report should include notes of any observations, including environmental and body temperatures and the general condition of the body prior to its removal. If the pathologist was present at the time the body was removed, then he or she should document his or her involvement in this removal.

7.2.5 External appearance of the body

This section should begin with a note of the state of the body as received in the mortuary and a description of the presence of any bloodstaining, etc. An inventory of the clothing must be made as it is removed from the body. Within this section should be a note of the height, weight and build of the individual. The presence and extent of rigor mortis should be tested for and noted if relevant. The position of post-mortem lividity should be recorded.

The condition of the hair, eyes, ears, nose, mouth, scars, tattoos, fingernails, and so on should be noted, even if these are normal. In the case of children hydration status and nutritional status should be recorded. Negative findings, such as the absence of petechiae in the eyes in suspected neck compression cases, are just as significant as positive ones and should be recorded.

7.2.6 Injuries

Injuries, no matter how trivial, must be described in detail using recognised terms with measurements given. The position of injuries must be described with reference to appropriate anatomical landmarks, and in some instances with reference to the height above the heel. The description must include the type of injury and an indication of whether it is of recent origin. A numerical identification may be particularly useful when reference is made to specific injuries in other parts of the report. It may be helpful to record the injuries on an outline body chart, as this may assist the pathologist, and others, in subsequent discussion of the case.

A separate section of the report dealing specifically with injuries may prove to be the easiest way of recording these injuries, including both external and internal features. In general the injuries will be described in sequence from head to foot, from right to left and from front to back, although in some cases the major injuries may be described first or the injuries may be grouped according to type of anatomical location.
7.2.7 Internal examination

If an internal examination is warranted, the internal examination must follow the recommendations in the Royal College of Pathologists of Australasia Guidelines on Autopsy Practice. For ease of reading, the report should be divided into sections and each section given an appropriate heading. Particular attention should be given to those organs that are diseased or injured. It should also include the presence or absence of skeletal injuries or skull fractures.

Where features out of the ordinary are found and the pathologist concludes that they are not relevant, the reasons for discounting these findings must be explained. In addition to a full description of all the major organs, their weight should be recorded. Descriptions should be objective.

Some pathologists choose to document their post-mortem report based on organ systems, such as the central nervous system, cardiovascular system, respiratory system, and so on. Other pathologists prefer to use an anatomical description of the body and refer to organs in their anatomical locations, such as head and neck, chest and abdomen. These are issues for the individual pathologist and should be dictated by the ease with which the pathologist will present his or her evidence in court.

7.2.8 Supplementary examinations

Included in this section are the results, if available, of toxicological analysis, x-rays, neuropathology, histology and any other tests or examinations that were carried out.

Where test results or other findings that are the work of another person are included in the report, it must be made clear who has made that finding or produced the results.

If it is necessary to refer specimens and organs for a second opinion to an expert in that area, the procedures for the handling of such specimens are outlined in Appendix No. 23. For further information dealing with such specimens, contact the expert directly.

7.2.9 Opinion and conclusions

In this section the pathologist should attempt to explain the cause and mechanism of death, as well as other findings, in language that is easy to understand. The information must be set out clearly and in a comprehensive manner to allow interpretation of the information by the police, Coroner, DPP and other counsel.

The opinions expressed must be fair and unbiased and under no circumstances should be written to assist one side rather than the other. No information that may have a significant bearing on the death should be excluded in order, for example, to shorten or simplify the report. When giving an opinion the pathologist must state clearly where that opinion is based on his or her own work and where it relies on the work, pathological findings and test results of others.

A well-thought-out opinion will be invaluable in allowing Coroners to determine how best to dispose of the case and the DPP to decide whether to proceed with a prosecution. This may have significant ramifications; for example, in facilitating the release of a prisoner in custody or preventing a potential miscarriage of justice. There may also be financial implications if the decision is taken not to proceed with the case.

Where possible, comments may include details such as, the type of weapon, the direction of injuries and, where appropriate, the amount of force likely to have been used and rapidity of death. In circumstances in which an assessment of the likely time of death is required, it must be given with adequate margins of error that can be readily explained. It is important to distinguish injuries that may be unrelated to the circumstances of the death.

The conclusions reached following an examination should be clearly set out in the report and it is usually appropriate to give the reasons for reaching these conclusions. It is also important to give some indication...
of the limits of reliability of such conclusions. Possible alternative explanations or opinions should be given. Where features out of the ordinary are found and the pathologist concludes that they are not relevant, the reasons for discounting these findings must be explained.

From the scientific findings the pathologist may be able to construct a picture of the sequence of events that occurred. However, the pathologist must clearly state how much of this is speculation. If the findings suggest more than one picture of the sequence of events then all the relevant scenarios must be stated.

Any opinion expressed by the pathologist is based upon the information and experience that he or she has at the time of expressing that opinion. If further information or later experience indicates that the original opinion needs to be altered, then the pathologist should feel able to change his or her opinion to make the report more accurate or objective.

7.2.10 Cause of death

Within the report, this should be given in the usual manner in the standard World Health Organization death certificate format. This system may not be familiar to lawyers and others who will read the report, so it may be important to elaborate on this information.

If, having considered all the evidence, no cause can be reasonably found, then the pathologist must record that the cause of death was unascertained or undetermined. A cause of death certificate will be issued by the Coroner.

7.2.11 Retention of samples

The report must clearly indicate what materials have been retained and submitted for further scientific examination, such as blood samples and swabs. It is essential to include a list of any organs retained for further examination, together with a note indicating where they are stored, whether or not specific permission has been obtained for the retention of these tissues and what the method of their disposal is to be. If no organs are retained, a simple statement to this effect in the report is sometimes beneficial.

7.2.12 Final check

Before the report is signed and issued the pathologist must check it for errors, such as typographical and grammatical mistakes. Simple mistakes like substituting “left” for “right” and “millimetres” for “centimetres” may significantly alter the interpretation of the finding by the reader.

Furthermore, a poorly presented report with multiple errors gives the impression of a lack of care or interest in the completion of the report and, by inference, in the conduct of the autopsy and in the interpretation of the findings. As a final step in all cases of unnatural death or cases likely to be the subject of an inquest or criminal proceedings, a cautionary statement must be signed by the pathologist and witnessed officially, in most cases by the Coroner.

7.2.13 Time of submission of the report

The post-mortem report must be submitted to the Coroner and to the police as soon as practically possible. In some instances it is appropriate to submit a preliminary report detailing the expected timing of pending interim and final reports. If there is to be a significant hold-up, the reasons for this should be given and explained. Normally, delays should only be occasioned by the need for time-consuming special investigations, such as toxicology, neuropathology or cardiac pathology. Routine histology should not be a reason for significant postponement of a final report. However, it is preferable that the report is as detailed and comprehensive as possible, even if this does cause some delay in its completion. In most instances this will be more helpful to the user than the issue of multiple supplementary reports or statements.
7.2.14 Disclosure of information to the defence in criminal cases or to other interested parties

A Coroner’s post-mortem report has been prepared for the Coroner. Therefore, while it is subject to disclosure, this should normally be done only through the office of the Coroner or with his or her direct permission.

In many cases involving the deaths of individuals in hospital, requests will be made by the clinicians for access to the post-mortem report for medical audit purposes. In non-criminal cases this will usually present no difficulties and can be provided routinely with the consent of the Coroner.

In cases subject to criminal investigation, such disclosure of a post-mortem report should only be done after discussions with the Coroner, and often the police and DPP. Public interest considerations outlined in Section 14 of the Government Information (Public Access) Act 2009 should provide guidance as to whether the report should be provided to the requesting party.

A post mortem report must be provided to the Court if a lawful order, such as a subpoena has been issued.
8 FURTHER READING


*Medical Expert Witnesses – Guidance from the Academy of Medical Royal Colleges*, [www.aomrc.org.uk](http://www.aomrc.org.uk).


*Sudden Unexpected Death in Infancy – A multi-agency protocol for care and investigation*, The Royal College of Pathologists and The Royal College of Paediatrics and Child Health, September 2004, [www.rcpath.org](http://www.rcpath.org) and [www.rcpch.ac.uk](http://www.rcpch.ac.uk).


**APPENDIX 1. Forensic pathology post-mortem attendance record**

<table>
<thead>
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<tr>
<td>Time:</td>
<td>_____________________________</td>
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<tr>
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<tr>
<td>Radiographers:</td>
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APPENDIX 2. Post-mortem Interim Report of death

DEPARTMENT OF FORENSIC MEDICINE
INTERIM REPORT

To State Coroner

Date: ........................................

GIVEN NAMES           SURNAME           CASE NO.

Interim Cause of Death:

I. Direct Cause - Disease or condition directly leading to death ..................................................
   (due to or following)
   (a) ___________________________________________________________________

Antecedent Causes - Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last.
   (due to or following)
   (b) ___________________________________________________________________
   (c) ___________________________________________________________________

II. Other significant conditions contributing to the death but not relating to the disease or condition causing it
    ________________________________________________________________________
    ________________________________________________________________________

Further coronial investigation suggested

The body may be released □

The body may not be released □ Reason for non-release: __________________________

Further investigations are being performed:

Specimens retained at IOFM: Forensic Science Laboratories Analytical Laboratories Other Laboratories

<table>
<thead>
<tr>
<th>Samples of tissue</th>
<th>Blood</th>
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<td>Liver</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Other</td>
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<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Radiology performed

Photographs taken Y/N by ____________________________

Whole organs for examination: Remarks:

Brain □

Heart □

Other □ Signature: ____________________________

Reason for retention: Print Name: ____________________________

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APPENDIX 3. Standard guidelines: Sudden, presumed natural, adult death

Individual pathologists will differ in the format and detail of their reports. However, it will be reasonably assumed that all of the following detail has been examined, if not documented in the Autopsy Report.

1. Presumed natural adult death autopsy

Name of pathologist:
Deceased’s name and age:
Time, place and date of examination:

1.1 External examination

General description. Record length and weight.
Identifying features including scars, tattoos, hair and teeth.
Signs of medical intervention.
Description of all external injuries.
Post-mortem changes including lividity, rigidity, changes of decomposition.

1.2 Internal examination

Cardiovascular system

Pericardial fluid – description of fluid.
Heart:
weight;
assessment of chamber size and thickness;
description of myocardium; and
description of valves.
Coronary arteries:
comment on configuration;
distribution and severity of stenosis; and
presence/absence of old or recent occlusions.
Major arteries:
aorta and carotids; and
distribution and severity of atheroma.

Respiratory system

Diaphragm – description.
Larynx-trachea – integrity of neck structures.
Pleural cavities:
description of pleura, adhesions; and
description of fluid, assessment of volume.
Lungs:
lung weights;
description of external and cut surfaces; and
presence or absence of key pathological conditions, e.g. pneumonia, neoplasm as relevant to
case.
Bronchi – description of mucosa.
Pulmonary artery:
   description; and
   emboli.

**Gastrointestinal system**
Oesophagus – description.
Stomach contents:
   general assessment of volume of contents; and
   description of mucosa.
Small/large bowel – general description.
Liver:
   weight; and
   description.
Gallbladder/ bile ducts – description.
Pancreas – description.
Peritoneal cavity – description.

**Genito-urinary system**
Kidneys – weight, description of external and cut surfaces.
Ureters – comment.
Bladder – description, assessment of volume and contents.
Reproductive organs – description.

**Central nervous system**
Cerebral arteries – description.
Meninges – description of surface.
Brain:
   weight; and
   Description of external surface and cut surfaces (see CNS examination below).
Pituitary – description.

**Reticuloendothelial system**
Spleen:
   weight; and
   description of external/cut surfaces.
Lymph nodes – description.

**Endocrine system**
Thyroid – description.
Adrenal glands – description.
Musculoskeletal system

Description.

1.3 Specimens

The selection of tissues for histology is purely at the discretion of the pathologist. Below is a suggested protocol. However, the pathologists must histologically examine sufficient organs thoroughly so that any case can be adequately peer reviewed or audited with confidence in respect of the cause of death.

Histology

(To include representative sections of abnormal findings.)

- Coronary artery At least one section from representative areas of most severe disease.
- Heart Sections from relevant regions of left and right ventricular myocardium.
- Lungs One section from each.
- Kidney One section from kidney.
- Liver One section.
- Brain Relevant sections according to case type (see “Examination of the central nervous system” below).
- Sections of further organs and tissues as indicated by the particular case.

Toxicology

As indicated (see Appendix 4).

Microbiology

As indicated.

Radiology

As indicated.

1.4 Summary of major anatomical findings

1.5 Cause of death

1.6 Comments

Brief explanation of disease (as indicated).

Relevant medico-legal issues that have been identified at the time of completion of the autopsy report.

2. Examination of the central nervous system

The following comments refer to the examination of the unfixed brain in the context of a routine examination for the coronial service.

If the brain is very soft or oedematous, cooling it for an hour in a refrigerator may make it easier to obtain uniform slices. Wetting the brain knife between sections eases slicing. In most conditions the cerebral hemispheres are best sectioned coronally in 1cm-thick slices, the cerebellum radially in pie slices and the brain stem sectioned transversely.
If generalised subarachnoid haemorrhage is found, examine the arterial system first, removing blood clot from around the vessels with a blunt-edged instrument. If no ruptured berry aneurysm is found, peel back the larger arteries of the anterior cerebral and vertebro-basilar systems for closer examination (a posteriorly-directed aneurysm may be difficult to locate with the arteries attached to the brain surface). If no extracerebral source is found, section the brain to look for an intracerebral source of haemorrhage with rupture into the ventricular system. Consider the possibility of a traumatic basal subarachnoid haemorrhage. In such cases, a detailed neuropathological examination of the fixed brain is required, and a detailed examination of the entire extracranial and intracranial course of the vertebral arteries is essential. When trauma is assessed, contusions and haemorrhages are described. Small haemorrhages (often petechial) in the corpus callosum and dorsolateral segments of the rostral pons in the unswollen brain suggest diffuse axonal injury (DAI). Brain swelling, with tentorial herniation and secondary haemorrhages in the midbrain/rostral pons, complicates the diagnosis of DAI.

Haemorrhages with DAI are not into the perivascular sheath, but into the tissues. Haemorrhages into perivascular sheaths are non-specific/agonal in type, apart from high-speed crashes associated with many perivascular haemorrhages in white matter. In this case, diffuse vascular damage (DVD) is likely to have occurred. DVD is usually a rapidly lethal condition, with death at the scene.

2.1 Histology

Tissue blocks for assessing trauma should include:

- one section of a contusion;
- posterior corpus callosum;
- thalamus;
- transverse section of the rostral pons; and
- sections of the medulla in infants/children under the age of 4 years.

Amyloid Precursor Protein (APP) immunostaining can show axonal pathology from about 90 minutes after trauma or other types of damage.

Assessment of global hypoxia/ischaemia includes trying to decide whether the brain is affected by either cardiac arrest or by severe hypotension. Hypoxia/ischaemia should be screened for in the setting of trauma.

Sections best examined are:

- parasagittal occipital cortex ("border zone" cortex);
- hippocampus;
- thalamus;
- inferolateral cerebellar (border zone) cortex.

With resuscitation after cardiac arrest, the Sommer’s sector of the hippocampus should show extensive neuronal ischaemic cell change (ICC), as well as the occipital cortex and the thalamus if CPR was prolonged. Hypotension without cardiac arrest is suggested by sparing of the Sommer’s sector from ICC, and some involvement of the thalamus. If infarcts are also present in the occipital cortex ("accentuation"), then abrupt onset/rapid resolution of hypotension is suggested. If there is no occipital accentuation but widespread cortical ICC and severe thalamic ICC, it is likely hypotension was slow in onset or resolution.
**Chronic hypertension** is associated with arterial hyaline sclerosis and loosening of perivascular tissues. The best sections to screen for hypertension are from:

- the basal ganglia (caudate nucleus and/or the lenticular nucleus); and
- the pons and cerebellar white matter in severe hypertension.

**Spinal cord fixation** Open the dura longitudinally front and back, then snip through the dura laterally between every third spinal nerve root. The cord may then be put into a wide container in formalin and it will fix without the kinking caused by contraction of the dura.

If the spinal cord is also to be examined microscopically, remove the cord first from the posterior aspect. Imaging using CT scan or MRI prior to dissection may be useful in providing a permanent record of fractures especially in the upper cervical spine which may be difficult to access.

For further information relating to the examination of the CNS, contact a neuropathologist.
APPENDIX 4. Guidelines for sampling standards for toxicology and biochemistry

Discuss with your Toxicology service provider if you are unsure how to proceed. If you are unsure regarding where testing for a specific substance may be performed contact the Senior Forensic Pathologists at Glebe or Newcastle for advice.

Specimens may be retained to be analysed at a later date at the discretion of the pathologists. If specimens are to be stored within the mortuary, ensure adherence to correct storage conditions in order to ensure optimum preservation for later analysis.

1. Non-suspicious, non-natural deaths, including motor vehicle collisions, accidental deaths and all suicides
   - Preserved blood.
   - Urine – preserved and unpreserved.
   - Liver.
   The analysis is to include all prescribed psychotropic drugs and alcohol.

2. Suspected narcotic deaths
   - Preserved blood.
   - Urine – preserved and unpreserved.
   - Liver.
   - Gastric contents.
   - Bile.
   - Vitreous humour biochemistry in MDMA-related deaths.
   In suspected injection sites, tissue can be taken for toxicology and histology.

3. Homicides, suspicious deaths and industrial (workplace) accidents
   - Preserved blood.
   - Urine – preserved and unpreserved.
   - Liver.
   - Bile.
   - Gastric contents.
   In some cases, brain and lung tissue may be analysed for solvents, and hair and bone for heavy metals. As it is not routine, it is advised to discuss these cases with DAL toxicology laboratory.

4. Sudden unexpected death in infancy

   Toxicology
   - Preserved blood.
   - Urine – preserved and unpreserved.
   - Liver.
   - Gastric contents.
Biochemistry

Vitreous humour.

Each pathologist must establish a close working relationship with the Toxicology service if they are not under the same management structure. The relationship should be formalised to include particulars of samples requested in different case sets.
APPENDIX 5. Standard guidelines: Deaths associated with fire

The following document addresses the standard for a post-mortem examination in the case of a death associated with a fire. The specific issues described are in addition to the standard required for a sudden, presumed natural, adult death (see Appendix 3).

It is mandatory that in all cases where carbonisation of the body has occurred, potentially obscuring evidence of an ante-mortem injury to the skin, full radiographs are performed and reviewed prior to the post-mortem examination. The major issues for the pathologist are the cause and manner of death, and identification of the deceased.

1. **External examination**

   Description of the extent and distribution of burn injuries to the body. Specific comment on areas of spread (non-burnt) skin. Does the distribution of the burns indicate the position of the body?

   Description of any external features that may assist with identification. Are the hands and fingers burned?

   Description of residual clothing. If clothing is to be retained for analysis of accelerant, then place in “volatiles bag”, tin or glass container.

2. **Internal examination**

   **General**

   Document any injury, anatomical variant or previous surgery.

   **Respiratory system**

   Larynx / trachea:

   Document presence/absence and distribution of soot within the larynx and trachea and major bronchi. Does soot extend below the level of the vocal cords?

   Consider photography.

   **Gastrointestinal system**

   Appendix – document presence/absence of appendix.

   Gallbladder – document presence/absence of gallbladder.

   In cases of severe charring, identify gonads and take histology if necessary for identification purposes.

   **Head**

   Note the presence of extradural haematomata and determine whether or not they are artefactual.

   Note if there are any skull fractures and whether these are ante-mortem or post-mortem in nature, or heat-related.

   **Additional histology**

   Trachea, lung sections to include peripheral bronchi.

   Appendix and gonads if identification is an issue.
Toxicology

Full toxicology, including alcohol, carbon monoxide and cyanide if available.

Consider volatiles.

May be difficult to obtain in severe incineration. Discuss sample selection with toxicologists (e.g. liver blood or skeletal muscle)
APPENDIX 6. Standard guidelines: Maternal deaths

This document addresses the standard for a post-mortem examination in the case of a maternal death. The specific issues described are in addition to the standard required for a sudden, presumed natural, adult death (see Appendix 3). Maternal deaths should be addressed within 24 hours of arrival at the morgue.

1. **Definition**

A maternal death indicates a death that occurs during pregnancy or childbirth, or within 42 days of the puerperium, from a medical cause related to or aggravated by the pregnancy or its management, irrespective of the duration and site of the pregnancy.

Deaths related to pregnancy are categorised into:

- **Direct** – the disease is caused by being pregnant and/or delivering a baby (consider thromboembolic disease, hypertensive diseases of pregnancy, HELLP syndrome, TTP, amniotic fluid embolism, early pregnancy deaths (eg ectopic pregnancy), genital tract sepsis, fatty liver disease, trauma, anaesthesia, air embolism, choriocarcinoma, hydatidiform mole, Ogilvie’s syndrome)
- **Indirect** – cardiac (exacerbation of congenital heart disease, acquired cardiac disease), hypertension (not due to pregnancy), diabesity, psychiatric, epilepsy, malignant disease worsened by pregnancy, other conditions exacerbated by pregnancy
- **Coincidental** – not related to the pregnancy

2. **Clinical information required**

- all clinical information on past pregnancy history and present pregnancy
- clinical and drug history regarding pre-existing medical conditions
- foetal/neonatal history

Consider discussion with treating obstetricians and other clinicians prior to autopsy

3. **Specific significant organ systems**

- Heart – malformation, acquired disease, air embolism
- Arterial system – aneurysms, aortic dissection
- Lung – amniotic fluid embolism (high CW cytokeratin markers useful), thromboembolism, shock lung
- Brain – haemorrhage and other strokes, consider Wenicke’s encephalopathy
- Uterus and genital tract:
  - particular attention to possible trauma
  - fallopian tube and ovary in cases of ectopic pregnancy
- Placenta
- Bone marrow, spleen (esp if sickle cell disease suspected)

4. **Recommended minimum blocks**

- both lungs, all lobes
• heart
• liver
• kidney
• brain
• uterus
• placenta

5. Other samples
• blood culture for bacteraemia
• genital tract microbiology
• fresh tissue for genetic studies (eg suspected Marfan’s, Ehlers-Danlos)
• review of any previous pathology specimens from surgery relevant to this pregnancy

Adapted from the RCPath Working Party on the Autopsy – Maternal Deaths
APPENDIX 7. Standard guidelines: Sudden Unexpected Death in Infancy (SUDI)

Autopsies for infants should be undertaken as soon as possible. The presence (or absence) of an appropriate referral should be clearly documented in the autopsy report, as should all investigations undertaken (including skeletal surveys and photography).

Where the death follows an immunisation, whether the pathologist believes this contributed to the death or not, this should be notified to the local public health unit as required by the NSW Public Health Act.

Follow NSW Health PD2008_070 *Death - Management of sudden Unexpected Death in Infancy* or its successors.
APPENDIX 8. Standard guidelines: Cause of death unascertained at post-mortem examination

The following document addresses the standard for a post-mortem examination in the case of an unascertained cause of death in a Coroner’s case. These features are in addition to those outlined in the standard for sudden, presumed natural, adult death (see Appendix 3).

1. Internal examination

Cardiovascular system

Heart – careful assessment and interpretation of left and right ventricular thickness (level of papillary muscles).

Respiratory system

Upper airway – specific comment on oedema of the larynx & epiglottis. In anaphylaxis there may be no physical signs at autopsy. History of exposure to antigen e.g. bee sting, ant bite, peanuts or antibiotics in these cases is often critical.

Lung – specific comment on airways – presence of foreign body and/or mucus.

Central nervous system

Brain – consider consultation with a neuropathologist prior to conclusion of the autopsy.

2. Specimens

Additional histology

Heart – at least one section of anterior, lateral, posterior and septum of left ventricle and one section of right ventricle. Consideration should be given to dissection and examination of the cardiac conduction system.

Coronary arteries and aorta for evidence of vasculitis.

Adrenal gland – one section from each gland.

Pancreas – one section.

Spleen – one section.

Lymph node – one section.

Bone marrow – one section.

Skeletal muscle – at least one section including quadriceps and deltoid. Discuss with neuropathologist first. Sample and preserve according to standard muscle biopsy protocol.

Pituitary – one section including neuro- and adenohypophysis.

Kidney – section from each kidney.

Brain – sections of each hippocampus, at least one section of parasagittal occipital cerebral cortex, midbrain, pons and cerebellum. Consider referral of the brain and spinal cord to a neuropathologist. NB this would involve sending the tissue interstate and should be discussed with the coroner and the neuropathologist at the time of autopsy.

Retention of tissue

Toxicology – full toxicological examination. Consider specific poisons.
Biochemistry – special post-mortem chemistry – vitreous for potassium, sodium, urea, creatinine, chloride, ketones and glucose, blood or serum for mast cell tryptase & RAST, \( \beta \)-hydroxybutyrate (CSF), HbA1C.

Genetic – blood should be retained for prolonged QT interval genetic testing.

Microbiology – microbiological and viral cultures as indicated.

Radiology – radiographs as indicated.

3. **Cause of death**

It is accepted that in a small minority of autopsies the cause of death will not be determined despite extensive ancillary investigations, including review of the past medical and family history and circumstances of the death. However, every effort must be made to exclude a potential cause of death before it is concluded that the cause of death is unknown or unascertained.

Where the death follows an immunisation, whether the pathologist believes this contributed to the death or not, this should be notified to the local public health unit as required by the NSW *Public Health Act*.

Before a coronial autopsy report is signed, where the cause of death has been designated as undetermined or unascertained, it is accepted best-practice that the case is referred to a Forensic Pathologist for a review.
APPENDIX 9. Standard guidelines: Deaths occurring in custody

The following document addresses the standard required for a post-mortem examination in the case of a death in custody. The specific issues described are in addition to the standard required for a sudden, presumed natural, adult death (see Appendix 3).

1. Definition

A death in custody refers to the death of an individual while in prison, under arrest or in the process of being detained by the authorities.

Deaths in custody may be natural deaths, accidental deaths, suicides or homicides. Given the public scrutiny of the justice system, all such deaths should be referred to a Forensic Pathologist.

2. Autopsy

2.1 Introductory comments

The post-mortem examination should be performed as for a homicide case or suspicious death, with appropriate investigating police personnel and a police photographer in attendance.

A record of resuscitative measures undertaken by ambulance personnel, warders or prisoners must be available to the pathologist prior to the examination.

2.2 External examination

- Complete photographs of the body, including close-up photographs of the face (including teeth) and hands.
- If Oleoresin (capsicum) spray may be involved, examination under ultraviolet light and appropriate swabs are mandatory (see specimens).
- Document the presence/absence of injuries to the external genitalia/anus (see specimens).
- Document the presence/absence of petechial haemorrhages on the conjunctivae, peri-orbital skin, retro-auricular skin and buccal mucosa.

2.3 Internal examination

Respiratory system

In cases of possible neck restraint, after the brain and visceral block (excised at the thoracic inlet) have been removed a formal neck dissection must be performed (see Appendix 22).

Gastrointestinal system

The gastric contents should be collected. The entire small and large bowel should be opened in order to exclude the presence of illegal drugs and/or body packing.

Genito-urinary system

A formal pelvic dissection is recommended with photographs of the dissected specimen (see Appendix 22) if indicated.

2.4 Specimens

- Swabs and smears from the oral cavity, anus, rectum, low and high vagina. Swabs must be performed prior to temperature recordings.
- Fingernail scrapings.
- Full routine toxicology.
• Full body radiology if required.
• Alcohol swabs for presence of Oleoresin capsicum (if indicated).
APPENDIX 10. Standard guidelines: Death related to an anaesthetic

The following document addresses the standard for a post-mortem examination and report in the case of death related to an anaesthetic. This may be defined as a case where the anaesthetic is considered to have substantially contributed to the death. In general, these deaths will have occurred during the operative procedure or in the immediate post-operative period. The specific issues described are in addition to the standard required for a sudden, presumed natural, adult death (see Appendix 3).

Such cases should not be examined by a hospital pathologist on the medical staff of the hospital concerned and should be referred to a Forensic Pathologist.

1. Preparation prior to post-mortem examination

It is mandatory for the pathologist to review the relevant portions of the medical record prior to the autopsy. No examination should commence without the medical records, including the operative and anaesthetic records, being made available to the pathologist.

It is important to consider the need for appropriate radiographs to be performed and examined prior to the autopsy. The radiographs performed may vary according to the particular clinico-pathological problem. In particular, consideration must be given to the possibility of air embolism. The autopsy should be conducted in such a fashion as to detect this. Consult standard forensic texts for autopsy protocol for air embolism.

Speak to the anaesthetist regarding interrogation of the machine data logger.

2. Radiology

- CT scan for demonstration of gas within the heart and great vessels.
- Documentation as to the degree of pneumothorax.
- Other radiographs as indicated.

3. Photography

To provide an objective and permanent record of any significant findings during the post-mortem examination, the liberal use of high-quality, correctly labelled photographs should be considered as they provide the opportunity for review by other interested parties at a later date. For example, a photographic record of the position of the endotracheal tube may be useful.

4. External examination

- All monitoring equipment, vascular cannulae, intrathoracic drains and other catheters, endotracheal tubes, etc. must be documented.
- Ensure that the endotracheal and arterial lines were correctly positioned.
- Record the contents and the labelling of, and the volume retained in, ‘intravenous bags’.
5. **Internal examination**

The pathologist may consider performing at least some of the dissection *in situ*. At the very least, the position of the endotracheal tube should be documented prior to removal of the organ block.

**Cardiovascular system**
- Document the presence/absence of a congenital heart disease.
- Integrity of vascular structure if intravascular lines are *in situ*.

**Respiratory system**
- Measurement of volume of blood and other fluid within the pleural cavities.
- Integrity of the trachea and major bronchi.

**Genito-urinary system**
- Measurement of volume of urine within the bladder (or syringe) if indwelling catheter is *in situ*.

**Central nervous system**
- Consider consultation with specialist neuropathologist.
- Include all dura for examination of venous sinuses.
- Consider excision and fixation of spinal cord if clinically indicated.

6. **Specimens**

**Histology**
Skeletal muscle. Examine in order to facilitate the diagnosis for malignant hyperthermia. First, discussion should be had with the neuropathologist after review of the medical notes. It is advised that additional pieces of major organs be retained for possible further histochemical examination and electron-microscopy if necessary.

**Toxicology**
Retention of full toxicological samples for storage is mandatory (Liver, urine, stomach contents, bile & if relevant lung). A full list of anaesthetic and other drugs administered should be included with the toxicology request forms.

**Microbiology**
As indicated.

**Haematology**
Because of the medico-legal implication, if there is the clinical suggestion of a transfusion incident, the relevant materials and specimens should ideally be examined by a laboratory that is independent of the hospital. It is acknowledged that this may not be practical. Advice regarding relevant samples should be sought from a transfusion Haematologist.

7. **Cause of death**

In view of the fact that most pathologists have limited experience with deaths associated with an anaesthetic, it may be prudent to either seek advice from an independent anaesthetic expert on formulating the cause of death or list the cause of death in a descriptive way so that the contribution to the death by an anaesthetic may be reviewed by an independent body in a forum such as a Coronial Inquest.
APPENDIX 11. Standard guidelines: Deaths associated with the use of a firearm

The following document addresses the standard required for a post-mortem examination in the case of a death associated with a firearm. The specific issues described are in addition to the standard required in the case of sudden, presumed natural, adult death (see Appendix 3).

1. Introductory comments

It is advised that the clothing be examined prior to the post-mortem examination. See the notes on photography, below.

Prior to any firearm-related autopsy, x-rays must be performed. If available, a CT scan may be performed instead.

2. Radiology

Suicide (or cases where suicide is indicated): radiographs of involved body regions.

Cases where homicide is suggested: radiographs of involved body regions. At least consider fluoroscopy (where available) of the remainder of the body or full body radiographs.

3. External examination

Describe the entrance and exit injuries:

a) The presence/absence of soot and the size and shape of its area of distribution in relation to the centre of the entrance wound.

b) The presence/absence of powder markings (tattooing and/or stippling) and the size and shape of the area of distribution around the wound.

c) Accurately measure skin defect in two dimensions (relate to a clock face).

d) Measure and comment on the abrasion rim surrounding the skin defect. Is the distribution of this abrasion symmetrical or asymmetrical? Is there any evidence of “muzzle stamp”?

e) In the case of exit wounds, look for evidence of “shored” impact injuries.

Describe sites of gunshot entrance and exit injuries. Refer to:

a) the distance from the heel in centimetres; and

b) the distance from the midline, left or right, in centimetres.

Photography:

a) Photograph all entrance and exit injuries before and after cleaning, with and without a calibrated identification label.

b) Photograph hands if there is evidence of blood-spatter and soot.

Document whether gunshot residues have been sampled.

In possible suicides, measure the distance from the acromio-clavicular joint to the olecranon and the distance from the olecranon to the tip of the middle finger.

4. Internal examination

Document anatomical structures damaged by the gunshot discharge.

Bullet fragments should be retrieved. If there is extreme fragmentation, the majority of fragments can be
retrieved by ‘panning’ in a shallow dish.

Under no circumstances should the projectile or metallic fragments be handled with metal instruments. All bullets and bullet fragments must only be retrieved with plastic forceps to prevent artefactual scratching and marking.

Examine the projectile fragments for pieces of fabric or other attached debris. Determine the direction of travel of the bullet into or through the body.

5. **Specimens**

**Toxicology**
Full toxicology required.

**Histology**
Consider histology of the gunshot wound.

**Forensic science examination**
Consider requesting via the police that a Ballistics officer attend the autopsy. Consider trace evidence material for forensic science examination, including the use of a powder residue kit.

6. **Comments**

Briefly describe the anatomical site of entrance and exit injuries and the direction and structures damaged by the projectile(s).

Describe the pathological range of fire; i.e. contact, near contact, intermediate, or distant.

If the projectile is in situ, give a brief description of the projectile (jacketed, semi-jacketed, measurement of base of projectile). Each projectile recovered should be photographed and identified as to its location within the body and correlated with the x-ray images if possible.
APPENDIX 12. Standard guidelines: Deaths associated with neck compression and hanging

The following document addresses the standard for a post-mortem examination in the case of death associated with hanging (neck compression). The specific issues described are in addition to the standard required in the case of sudden, presumed natural, adult death (see Appendix 3).

1. **External examination**

The ligature should accompany the body to the mortuary and preferably be left *in situ* for the pathologist to examine at the time of the autopsy.

If present, the ligature should be described with special reference to its width, length, texture, the presence of cut ends and a brief description of any knots. Removal of the ligature should be done in such a way that the integrity of the knot is preserved.

**Head and neck**

Comment on presence of petechial haemorrhages within conjunctivae, peri-orbital and retro-auricular skin.

Note the distribution of petechial haemorrhage in relation to the ligature or site of neck compression.

Describe the ligature-abraded injury with reference to the width, direction (for example, transverse or oblique), and presence and site of skin spared of the abraded injury.

Note any weal reaction or bruising associated with the ligature mark.

Does the direction and distribution of the ligature mark indicate a point of suspension?

Compare any patterned quality to the neck abrasion with the ligature in question.

2. **Internal examination**

A formal anterior and posterior neck dissection is indicated (see Appendix 22).

The examination of the neck structures should be performed *in situ* after the removal of the brain and thoracic organs to “decompress” the blood vessels within the neck.

The “strap” muscles of the neck are sequentially reflected, beginning with the distal aspect of each individual muscle and dissecting toward the larynx. Each bruise within a muscle is documented as necessary.

The hyoid bone and thyroid cartilage and cricoid cartilage are examined for fractures and peri-osteal and peri-cartilaginous bruising and must be visualised and palpated to detect fractures. If necessary, these should be x-rayed.

Consider examination of the cervical spine. If necessary, a block of cervical vertebrae should be taken and cut sagittally to enable visualisation of the vertebral bodies and the intervertebral discs.

3. **Specimens**

**Toxicology**

Full toxicology as indicated by the case and at the discretion of the pathologist. At the least, blood should be retained for later analysis.

**Histology**

Literature suggests that intra-cartilaginous microscopic haemorrhages may occur in the neck compression
in younger individuals. Consider embedding the superior cornu of the thyroid cartilages and performing histological examination after decalcification.

4. **Examining for sexual assault**

Consider sexual assault examination in all young female victims of apparent suicidal hanging. At the discretion of the pathologist this may be performed by an experienced paediatrician or doctor with experience and training in examination of sexual assault victims. If the examination is to be performed by someone other than the pathologist, then the pathologist must be informed of the findings and conclusions of any sexual assault examination.

- Samples which should be taken include oral rectal and vaginal smears and swabs, wet and dry swabs of bite marks, scalp hair pubic hair and pubic combing.
- Poli light examination may reveal seminal fluid.
- Toxicology samples should include urine samples to detect some of the rapid acting benzodiazepines which may be no longer detectable in blood in a date-rape situation.
- If there is evidence of traumatic injury associated with sexual assault, consider in situ dissection of the vagina and rectum. (See pelvic dissection below).
APPENDIX 13. Standard guidelines: Deaths associated with scalds and chemical burns

This section addresses the standard for a post-mortem examination in the case of a death associated with a scald or chemical burn. It is not intended for deaths where the body is extensively charred due to fire. The specific issues described are in addition to the standard required in the case of sudden, presumed natural, adult death (see Appendix 3).

1. Introductory comments

In many cases of burns due to scalds from hot liquids or chemicals, there may be evidence of sudden incapacity either by disease, alcohol or drugs and these potential causative factors should be excluded at autopsy. Burns due to hot water, liquid chemicals or steam may produce partial thickness or full thickness burns and in many cases the heat injury may occur over a period of time. Microscopic examination of the margins of the injured areas may help with determining the timing of the scald.

2. External examination

The external examination should commence with the deceased clothed to allow examination of the clothing in situ.

Consider photography as a record of the distribution and severity of burns.

The extent of the injury must be estimated by the clinical “rule of nines” or as an overall percentage of the skin involved.

Examination of a scald should include a description of the injury with special reference to the relative distribution of full thickness, as opposed to partial thickness, scalds.

It is important that areas of non-involved skin be documented. “Shadow areas” of undamaged skin in the axillae, back or popliteal fossa should be described to aid with reconstruction of body position.

The description of the scald should include whether the injury is irregular and whether there is a distinct horizontal fluid level.

In cases of burns from dry heat, the presence of singeing of body hair should be described.

3. Internal examination

Gastrointestinal system

Make specific comment on the presence of mucosal burns within the upper gastrointestinal tract.

Make specific comment as to the presence or absence of chemical mucosal damage in the oropharynx.

Respiratory system

It is recommended that the tongue be removed and a formal neck dissection be performed (see Appendix 22).

The presence/absence of mucosal burns should be documented.

A specific comment is necessary on the presence or absence of soot in the airway in cases where fire is also implicated.

4. Specimens

Consider photography for pertinent positive and negative findings.
Histology

- Trachea and main bronchi.
- Relevant skin injuries.

Toxicology

This requires a full toxicological screen. Consider:

- volatiles;
- carbon monoxide;
- vitreous urea and electrolytes, especially in children;
- skin swabs; and
- hair (entrapment of volatile agents).

Forensic science examination (consider this)

- Clothing for accelerant.
APPENDIX 14. Standard guidelines: Deaths associated with motor vehicle accidents

The following document addresses the standard for a post-mortem examination in the case of death associated with a motor vehicle accident. The specific issues described are in addition to the standard required in the case of sudden, presumed natural, adult death (see Appendix 3).

One of the objectives of an examination is to confirm the location of each victim relative to the vehicles involved at the time of the accident. It is also essential to determine the possible significance of any natural disease process as a causative factor in the accident or in the prevention of survival in an otherwise non-fatal accident.

1. **External injuries**

   Document the pattern of injuries and relate them to the described circumstances of the accident.
   
   - Are there any apparent seatbelt injuries?
   - Is there evidence of secondary impact injury caused by ejection?
   - Is there evidence of injury unrelated to the accident?

2. **Internal examination**

   Document the position of intravascular lines, catheters, tubes, etc.

   **Cardiovascular system**
   
   - Note the presence of myocardial contusion/rupture.
   - Note the presence or absence of vascular disease.

   **Respiratory system**
   
   - Diaphragm – integrity.
   - Measure volume of blood – fluid in pleural cavities.

   **Gastrointestinal system**
   
   - Liver – capsular tears. Comment on depth of parenchymal rupture.
   - Haemoperitoneum – measure volume of blood/fluid.
   - Mesenteric tears and haemorrhage – comment.

   **Reticuloendothelial system**
   
   - Spleen – integrity of capsule/parenchyma.

   **Central nervous system**
   
   - Extradural, subdural haemorrhage (measure extent of haemorrhage and determine volume of blood).
   - Measure/comment on extent of contusions/laceration within brain.
   - Comment on evidence of brain herniation.
   - Comment on evidence of diffuse axonal injury.
Cervical/thoracic/lumbar spine – make specific comment on integrity.

**Musculoskeletal system**

- Skull – site and distribution of fractures.
- Ribs – site of fractures.
- Pelvis – comment on fractures.
- Vertebral column – comment on fractures and alignment.

In pedestrians measure lacerations/abrasions from the level of the heel.

Note: The severity of soft tissue injury and the pattern of fractures may assist in indicating a high or low-speed impact.

3. **Specimens**

**Histology**

Consider brain/lung/kidney tissue for possible fat stains (fat embolism). Pulmonary fat embolism may correlate with survival time.

Sections of brain to determine diffuse axonal injury (corpus callosum, parasagittal white matter, and pons).

**Biochemistry**

As indicated by the nature of the case, consider the need for vitreous humour analysis for electrolytes, etc.

**Genetic**

As indicated by circumstances of the case and past medical/family history, consider the need for Long QT analysis.

**Toxicology**

Appropriate toxicological examination in all accident victims.

**Radiology**

Consider radiographs, depending upon the case in question. X-rays will provide a permanent record of the nature of fractures and in some cases radiographs of the hand/wrist, etc. may reveal evidence of “control” fractures, which may require careful interpretation.

Specific radiographs may also assist with identification if the usual means of identification are not available.

4. **Comments**

Address all clinical problems referred to in the police report and Coroner’s instructions. Are the injuries consistent with the presumed location of the victim at the time of the accident?

Comment on the presence or absence of any disease or poison that may have been a factor in the accident.

Summarise the major injuries.

Comment on the presence or absence of injuries unrelated to the accident.

In all pedestrian fatalities, including all hit-and-run accidents, the clothing should be left on the body to be seen, examined and removed by the pathologist at the time of the autopsy.

In all motor vehicle accidents it is the role of the pathologist, not the police, to document and correlate...
the injuries with the accident vehicle and, where necessary and available, attend and examine the vehicle(s) involved or consult with the Accident Investigation Squad to ensure that the relevant investigations have been performed.
APPENDIX 15. Standard guidelines: Deaths associated with transportation accidents including aviation, rail, boating and bus accidents

The following document addresses the standard for a post-mortem examination in the case of deaths associated with aviation accidents. The specific issues addressed are in addition to the standard required in the case of sudden, presumed natural adult death and deaths associated with motor vehicle accidents (see Appendices 3 & 15).

All aviation accident cases and major transportation accidents must be referred to the Forensic Pathologist.

In aviation accidents, all flight crew and victims must have a full autopsy examination.

1. Introduction

The Australian Transport Safety Bureau (ATSB) investigates all aviation, rail or marine accidents and incidents within Australia where the circumstances of which, in the ATSB's opinion, have or are likely to have significant implications for transport safety. The investigation is known as a safety investigation, although some other agencies refer to a safety investigation as a technical investigation.

The contact for Medical records in Australia is Aviation Medicine at the Civil Aviation Safety Authority (CASA) phone 131757.

2. Autopsy

The purpose of the transportation accident autopsy is to:

- reconstruct the accident sequence through injury pattern analysis;
- identify the remains;
- identify medical causation or contributing causation;
- identify pre-existing disease; and
- assess survivability of the accident.

Because of the severity of tissue and whole body disruption in aviation accidents, the requirements for completion of the aviation autopsy and report are more demanding than those that can usually be applied to other transportation accidents. However, the standards for aviation cases can be applied with relatively minor modification to all major transportation fatalities.

2.1 Requirements

- Personal and medical history of flight crew.
- History of the accident. Be familiar with the type of aircraft.
- Examination of the clothing.
- Gross autopsy examination.
- Radiological examination.
- Microscopic examination.
- Toxicological examination.
- +/- Biochemical examination.
The medical history of the flight crew should be available to the pathologist prior to the commencement of the autopsy. It is also worthwhile obtaining the medical records from GPs and/or other medical specialists.

If possible, visit the scene while the aircraft is in situ, and preferably before removal of the deceased. Communication with the crash investigators with exchange of information about the history, crash site and the autopsy findings may be helpful working out exactly what happened.

No clothing should be removed from the deceased prior to examination by the pathologist. This is especially important for safety equipment such as helmets.

2.2 Radiological examination

Prior to the autopsy, relevant radiological examination should be performed to document injuries that are not easily identified or documented during the autopsy.

Injuries to the distal limbs are particularly relevant and they may represent “control” injuries. Radiological examination can be conducted after removal of the clothing.

Radiological examination is also essential for the identification and later retrieval of foreign fragments where an explosion is suspected to have occurred.

2.3 External examination

Examine clothing and equipment; for example, a parachute for damage and fuel.

Document all injuries and the pattern of the injuries. Compare injuries with aircraft structure.

Restraint marks or injuries.

Note patterned injuries that may match with impact injuries caused by the interior of the cockpit or cab of the vehicle.

Photograph the injuries.

2.4 Internal examination

Cardiovascular system

- Document any pre-existing cardiac disease, in particular the coronary arteries. If necessary, remove and decalcify before sectioning.
- Consider examination of conducting system.
- Examine carotid and cerebral arteries.
- Document all injuries, noting the pattern of the injuries such as aortic tear and deceleration.

Respiratory system

- Presence/absence of pneumothorax.
- Any evidence of inhalation of smoke (pre- or post-crash fire or smoke).
- Presence or absence of frothy oedema fluid in the airways and lungs.
- The extent of injuries to lungs. Consider retaining a small portion of each lobe for subsequent fat stains (Comment: personally I’m not a fan of this, in that fat should be readily apparent on H&E staining, and the presence of fat in lung vessels in any event is not of much diagnostic value).
• Volume of pleural blood.

**Gastrointestinal system**

• Document injuries to liver, intestines and mesentery.
• Document the volume of blood in the peritoneal cavity.
• Document extent of retroperitoneal haemorrhage.
• Examine oesophagus, stomach and intestines for signs of inflammation, etc.

**Reticuloendothelial system**

Document injury to splenic capsule and parenchyma.

**Central nervous system**

• Document scalp bruising.
• Extradural, subdural and subarachnoid haemorrhage (measure extent of haemorrhage and determine volume of blood for extra and subdural haemorrhages). In the setting of thermal injury, differentiate between an antemortem extradural haematoma and heat-associated extradural collection of blood.
• Measure and comment on evidence of cerebral contusions/lacerations and haemorrhages. If cerebral haemorrhage is present, consider whether it is consistent with trauma or natural disease.
• Comment on diffuse axonal injury.
• Spinal cord – comment on integrity.

**Musculoskeletal system**

• Skull – site and pattern of fracture.
• Vertebra – site and pattern of fracture.
• Ribs – position and extent of fractures.
• Pelvis – extent and pattern of fractures.
• Limbs – extent and pattern of fractures.

2.5 **Specimens**

**Histology**

• Routine histological specimens.
• Consider brain, lung, kidney for fat stains (fat embolism).
• Brain – sections for assessment for diffuse axonal injury if sufficiently preserved.

**Toxicology**

• Full toxicological testing (blood, urine, liver, gastric contents, bile).
• Consider vitreous humour and muscle if there are limited specimens.
• Note that tissue samples from the skin have been used in the past for toxicological testing.

Air safety authorities may request further toxicology looking for therapeutic levels of prescription and non-prescription medications relevant to pilot behaviour e.g. antihistamines or herbal
preparations. The detection limits for these required may exceed those of normal forensic toxicology. Consider taking a second blood toxicology sample for this purpose.

**Biochemistry**

Vitreous humor analysis for U&E, ketones, chloride, and glucose.

### 2.6 Identification

Given the severe trauma in most aviation accidents and some transportation accidents, identification is also an issue for the Coroner and pathologist. There is no need to delay the autopsy while the identification is still pending.

Given the degree of trauma and fragmentation, identification may be confirmed by:

- odontology;
- fingerprints;
- clothing and personal effects;
- physical findings such as scars, tattoos, implants, etc;
- DNA;
- radiology; and
- circumstantial evidence.

Visual identification is frequently not possible due to trauma. If in doubt, proceed as above.

### 2.7 Comments

Summarise the major injuries and ancillary test results. Discuss any significant findings, including the absence of any expected findings; for example, the absence of expected toxicological detection of regular medication.

Are the injuries consistent with the proposed accident scenario?

Injury analysis:
- survivability;
- forces present; e.g. vertical and horizontal;
- accident reconstruction (impact with aircraft and/or environmental structures).

Presence or absence of natural disease and contribution, if any, to the accident.

Any other issues.
APPENDIX 16. Standard guidelines: Deaths associated with explosions

The following appendix address the standard for a post-mortem examination in the case of deaths associated with explosions. The specific issues addressed are in addition to the standard required in the case of sudden, presumed natural adult death (see Appendix 3). Further information can be found in Forensic Investigation of Explosions, 1998, Beveridge S, published by Taylor and Francis, London.

All deaths thought to be associated with explosions or explosive devices must be referred to a specialist forensic pathologist and should normally be conducted in the presence of the an appropriate forensic scientist.

1. Introduction

Because the vital trace evidence associated with an explosive device may be miniscule, it is important when handling the body that every effort should be made to protect, preserve and collect all such evidence.

2. The examination

The post-mortem examination can be conveniently divided into the following six separate phases.

- Identification.
- Radiological examination.
- Collection of surface evidence.
- Documentation of injuries.
- Identification of natural disease.
- Collection of internal samples.

2.1 Identification

Because extensive fragmentation can occur, collection, assembly and separation becomes paramount to ensure the number of victims involved is known. Note the following tools at your disposal.

- Identification of genitalia, breasts, etc. may be important.
- Fingerprints – any fragment of friction skin.
- Forensic odontology.
- DNA.
- Hair colour, skin colour, make-up and tattoos.

2.2 Radiology

All bodies must be x-rayed prior to commencement of the post-mortem examination.

Radiology will:

- allow for the identification of lethal missiles including bullet fragments;
- allow for identification and location of bomb fragments; and
- identify bone injuries not related to explosion but possibly related to torture.
2.3 Collection of surface evidence

- Traces of powder, bomb chemicals and bomb fragments should be collected by or under the direction of ESR forensic scientists.
- All such material should be photographed *in situ*.

2.4 Documentation of injuries

Injuries sustained in explosions are often directional and the intensity of injury is directly related to proximity to the explosion. Features to note include:

- the size, shape, number and location;
- foreign material such as oil or paint;
- the nature and extent of internal damage and bruising; and

All injuries can be classified as blunt-impact, incised wounds, penetrating, burns (chemical or heat) and fractures.

2.5 Categories of blast injuries

Primary blast injuries are caused by sudden changes in environmental pressure caused by the blast wave. These include ear and throat injuries, pulmonary injuries, gastrointestinal manifestations and neurological manifestations.

Secondary blast injuries are usually seen in relatively intact bodies. These include “body stippling”, which is an injury triad of punctuate bruises, abrasions and lacerations, and flash burns and welding of clothing.

Tertiary blast injuries usually fall into two groups: acceleration and deceleration injuries, including flail injuries and injuries associated with the collapse of surrounding structures.

2.6 Identification of natural disease

Examination of all the internal organs is an essential part of the autopsy process.

2.7 Collection of samples

- Full toxicology.
- Tissue and blood for DNA.
- All trace evidence as directed by ESR.
- Clothing and footwear.

Note: In some cases of sudden death in explosions, vagal inhibition may be the mechanism of death. In the case of short-term survival, the lung damage may be associated with ARDS.
APPENDIX 17. Standard guidelines: Deaths associated with immersion

The following appendix addresses the standard for a post-mortem examination in the case of death associated with immersion. The specific issues described are in addition to the standard required in the case of sudden, presumed natural, adult death (see Appendix 3).

This appendix is separated into two parts. Part 1 deals with non-scuba (self contained underwater breathing apparatus) deaths and Part 2 relates specifically to scuba-related deaths.

1. Deaths associated with immersion (non-scuba)

1.1 External examination

It is desirable that the body be examined clothed and the clothing and contents documented under the external examination. A careful examination with documentation of injuries is important in all cases of presumed drowning, with identification of ante- and post-mortem injuries supported by histology if necessary.

In the event of a suspicious drowning death, document external injuries carefully as minor bruising on the scalp, arms and legs may assume great significance.

1.2 Internal examination

Central nervous system

It is recommended that the brain be examined at the commencement of the autopsy, as the presence of a subdural or extradural haemorrhage may alter the investigation of the case.

Examine the cervical spine in any case that may have involved a fall from a height.

Respiratory system

- Larynx, trachea, major airways.
- A formal neck dissection is mandatory.
- Documentation of presence/absence of foamy material within airways.

Pleural cavities.

- Document and measure any pleural effusions.
- Document lung weights. Are the lungs dry or oedematous, bulky and hyperinflated?

Heart

Comment on the degree of dilatation of the right and left ventricles. Is there any froth in the right outflow tract?

1.3 Specimens

The usefulness of post-mortem chemistry and the Diatom test is still debated in the forensic literature. It is accepted that different pathologists will have different attitudes regarding the use of chemistry and the Diatom test. Diatoms are usually only helpful in locations with high numbers of diatoms e.g. in dams where diatomaceous earth is used in the clay lining. It should be accepted that at this point in time there is no one diagnostic test for drowning.
2 Deaths associated with immersion (SCUBA)

All such diving-related deaths must be reported to the Forensic Pathologist

On report of a scuba death, consideration should be given to attending the scene.

A relevant forensic investigation of a scuba-diving facility requires a coordinated and comprehensive team approach that involves the appropriate authorities diving medical experts, pathologist and investigating officers.

The scuba equipment should be examined by a person (or persons) capable of providing a verbal and written report to the pathologist on the state of the equipment. In the event that this is not possible, the examination should be undertaken by a pathologist with knowledge of scuba equipment. Particular attention should be paid to the regulator and the content of the tanks.

2.1 External examination

The diving equipment will be examined by an expert in the field.

Photographic documentation of the condition of the diving equipment is at the discretion of the expert examiner, but identifiable deficiencies should be photographed.

Radiological examination is useful but must be performed in the first 8 hours after death to be valid.

The scuba equipment should be inspected and removed as soon as possible

Where available, a CT scan of the body is the preferred means of radiological investigation. Recent study suggests that post-mortem off-gassing can occur during routine dives and may account for much of the gas seen at autopsy (see Cole et al 2006)

If CT scan is not available, the body may be x-rayed including the limbs, lateral chest and, where possible, an upright (45 degree angle) chest x-ray. These x-rays are to be taken immediately upon admission of the body to the mortuary or as soon as possible afterwards (see “Specimens – Radiology”, below).

Examine for subcutaneous emphysema.

2.2 Internal examination

Respiratory system

- Check for evidence of interstitial emphysema.
- Check for pneumomediastinum (common) and pneumothorax (rare).

Cardiovascular system

Check for evidence of pulmonary barotrauma & cerebral arterial gas embolism (PBT/CAGE).

The epicardial arteries and great veins may disclose air bubbles. The pericardial sac is filled with water and the right atrium and ventricle incised under water to display the presence of escaping bubbles (this finding is of limited value as it can be seen in PM off-gassing, decomposition & CPR).

The presence or absence of a patent foramen ovale must be documented.

Central nervous system

The brain may be referred for formal neuropathological examination.

Musculoskeletal system
While dysbaric osteo-necrosis is now uncommon consider examining the femoral head in commercial divers.

2.3 Specimens

**Histology**

Samples of all major organs must be retained for subsequent histological examination. In particular, careful histological assessment of the lungs must be carried out.

**Toxicology**

Full toxicological analysis.

2.4 Factors contributing to death among scuba divers

2.4.1 Physical effects of being under water

**Barotrauma.**

- Pneumothorax.
- Pneumomediastinum.
- Interstitial emphysema with compression of neck and upper chest structures.
- Pulmonary barotrauma/Cerebral arterial gas embolism (PBT/CAGE)

**Decompression illness.**

- Air embolism (local and paradoxical).
- Nitrogen narcosis.
- Carbon dioxide retention with “Deep-water black outs”.

Barotrauma occurs as a consequence of failure of pressure equalisation of gas-filled spaces and their immediate environment. The barometric pressure at sea level is approximately 1 atmosphere and every vertical descent of 10 metres adds a further 1 atmosphere of pressure. Thus, descent under water is associated with compression of gases within such spaces in addition to increased amount of gases in inspired air passing into solution with the plasma.

The dissolved nitrogen remains in circulation. The increased partial pressure of nitrogen results in dysfunction of the central nervous system, the condition known as “nitrogen narcosis”. The clinical features are similar to those of intoxication with alcohol.

Rapid ascent is associated with re-expansion of gases in body tissues. Within the lungs, this may lead to alveolar rupture, pneumomediastinum and rarely pneumothorax and/or interstitial emphysema. Pulmonary barotrauma/cerebral or cardiac arterial gas embolisation (PBT/CAGE) into an artery may result in ischaemia and infarction. Ascent also may lead to small bubble emboli causing decompression sickness (“the bends”) and after death post-mortem off-gassing. Failure of pressure equalisation within the middle ear and the environment by the Eustachian tube may lead to tympanic rupture or vertigo, although this is more common during descent.

2.4.2 Problems with diving equipment

- Loss of mask or flippers
- Leaks from faulty valves.
- Contamination of the tanks compressed air by carbon monoxide.
- Malfunctions of buoyancy compensator.
Accidental detachment of the air tag or connections.
“Out of gas”.
Oxygen neurotoxicity due to the use of “nitrox” diving.

Examination of the diving suit and equipment should be carried out by an individual with specialised knowledge of the equipment and with the appropriate qualifications and authority.

The diving equipment is examined by qualified officers at the Water Police unit of NSW Police.

Many divers now use dive computers. These can be interrogated to ascertain the dive profile. Some of the older computers will over-write the data in 48 hours so it is important to do this within 48 hours of the incident.

2.5 Cause of death

The cause of death can only be determined after due consideration of the autopsy findings, including ancillary studies, as well as the medical/family history, dive profile and history and results of the examination of the equipment.

The cause of death should not be determined on the basis of the autopsy findings alone.

3. References


APPENDIX 18. Standard guidelines: Deaths associated with anaphylaxis

The following appendix addresses the standard for a post-mortem examination in the case of death which may possibly be associated with anaphylaxis. The specific issues described are in addition to the standard required in the case of sudden, presumed natural, adult death (see Appendix 3).

"Anaphylaxis" is a clinical syndrome due to systemic mast cell degranulation which can be triggered by an ‘anaphylactic reaction’ (IgE mediated, from allergen exposure) or an ‘anaphylactoid reaction’ (non-IgE mediated, from substances/stimuli which release mast cell mediators directly). These are clinically & pathologically indistinguishable. Common triggers of each type of reaction (anaphylactic/anaphylactoid) include drugs, foods and insect stings.

A diagnosis of anaphylaxis is often on the basis of a consistent clinical picture and the exclusion of other causes of death. Mast cell tryptase levels may be helpful but are not necessarily diagnostic.

Strongly consider involving a clinician with expertise in the area of allergy/clinical immunology for gathering and assessing information obtained both from a detailed clinical history and the autopsy.

1  Death from ‘anaphylaxis’ can be due to

• Hypotensive shock (NB ‘empty heart syndrome’).
• Asphyxia (asthma, laryngeal oedema).
• Severe anoxic brain injury from either hypotensive shock or asphyxia above (e.g. patient resuscitated, put on life support, but does not regain consciousness – declared ‘brain dead’ – life support subsequently switched off).

2  The role of the autopsy

To determine whether there is:

• morbid anatomical evidence to support the suspected anaphylaxis and its timing.
• other pathological conditions that could account for death or contributed to death.
• biochemical evidence of anaphylaxis.
• serological evidence of the agent responsible for initiating anaphylaxis.

3. Clinical information relevant to the autopsy

Clinical picture (from relatives, witnesses, medical records, ambulance records etc) includes information about:

• past history indicating patient was ‘at risk’.
• known or suspected trigger.
• detailed food/diet history (if suspected food allergy).
• circumstances of exposure.
• timing of reaction in relation to exposure.
• prodromal symptoms.
• evolution & progression of symptoms/signs.
• tempo of reaction.
• pre-terminal posture & circumstances (sitting, standing, walking, running).
• action taken & response to treatment.
• details of current/past asthma (including Rx & degree of control).
• other co-factors/predisposing/aggravating factors (e.g. inhalant allergies/exercise/medications/illness).

4 Pathology encountered at the autopsy

• Often there is little or nothing specific to see, grossly or histopathologically.
• There may be laryngeal (or pharyngeal, or other upper airway) oedema.
• Pulmonary oedema, if present, may indicate adrenalin overdose.
• If the patient was resuscitated, survived but then died in intensive care, many additional pathologies may supervene.

5. The autopsy procedure

• A complete autopsy examination.
• Careful search for bee stings if there is appropriate suspicion.
• Specific significant organ systems:
  o Lung, larynx and airways examination for significant oedema (acute asthmatic death with airway remodelling of chronic asthma is typical of food anaphylaxis).
  o Coronary arteries and heart for contributory ischaemic heart disease (myocardial ischaemia is an inevitable consequence of anaphylactic shock, even with normal coronary arteries).
  o During coronary artery stenting, some patients may suffer allergic reactions to anti-clotting drugs or materials incorporated into the stent; this may also lead to local thrombosis from hypotension.

6. Laboratory investigations

• Full toxicology.
• Mast cell tryptase.
• Specific IgE against known/suspected/unsuspected triggers.
• Urgently seek any pre-mortem blood specimens (in pathology laboratories) before they are discarded.

Distinction between an anaphylactic and anaphylactoid reaction is retrospective, based on:
• nature of known or suspected trigger (from history, witnesses, other information);
• presence/absence of specific IgE (pre- or post-mortem).

7. References


The following document addresses the standard for a post-mortem examination in the case of death which may possibly be associated with ingestion of food-borne pathogens. The specific issues described are in addition to the standard required in the case of sudden, presumed natural, adult or child death (see Appendix 3).

Foodborne illness is caused by ingestion of contaminated food or drink. Secondary cases can occur through close contact with infected persons, with transmission generally occurring via the faecal-oral route.

A diagnosis of food poisoning is often on the basis of a consistent clinical picture and the exclusion of other causes of death. Microbiological, viral and serological testing may be helpful but are not necessarily diagnostic.

Foodborne illness is a notifiable disease under the NSW Public Health Act 1991 when it occurs in two or more related cases (that is, who are linked in time or place). Such events should be notified to the local Public Health Unit (PHU) by telephone within 24 hours of diagnosis, by hospital CEOs (or delegates) and by medical practitioners. Other specific causes of foodborne illness are notifiable by laboratories, e.g. salmonellosis.

In all cases of death from suspected food poisoning, advice should be sought from the local Public Health Unit, preferably prior to commencement of the autopsy.

1 Death from ‘food poisoning’ can be due to
   a. Dehydration
   b. Sepsis
   c. Bacterial toxin production
   d. Direct effects of the bacterial infection on the bowel (e.g. perforation)
   e. Hepatic or renal failure
   f. Neurological effects (e.g. meningitis, ciguatera poisoning).

2 The role of the autopsy
   To determine whether there is:
   • morbid anatomical evidence to support the suspected food poisoning and its timing
   • other pathological conditions that could account for death or contributed to death
   • microbiological evidence of food poisoning
   • serological evidence of the agent responsible for the food poisoning

3 Clinical information relevant to the autopsy
   Clinical picture (from relatives, witnesses, medical records, ambulance records etc) includes information about:
   • circumstances surrounding the suspected food poisoning
   • onset time of illness
   • symptoms (in particular anorexia, nausea, vomiting, stomach cramps, diarrhoea, fever, jaundice, neurological symptoms)
   • if other persons affected similarly
   • location of any suspected outbreak (e.g. an institution)

4 Pathology encountered at the autopsy
   • There may be little or nothing specific to see, grossly or histopathologically.
• Loose stools may be obvious, with or without mucous, blood
• Empty bowel
• Features of dehydration
• Rapid onset decomposition.

5 The autopsy procedure
• A complete autopsy examination.
• Specific significant organ systems:
  o Bowel
  o Other depending on clinical information available

6 Laboratory investigations
These can be discussed on a case-by-case basis with the Director of the local Public Health Unit and/or with a clinical microbiologist. If specialised faecal examinations are required, contact the Senior Scientist, Enteric Reference Laboratory, Centre for Infectious Diseases and Microbiology, ICPMR (contact details below).
Tests may include:
• Full toxicology
• Other e.g. blood culture, faecal specimen (if loose/unformed), specific histology
• Depending on clinical picture, consider ordering:
  • stool culture for salmonella, shigella, campylobacter, Shiga-toxin producing E. coli (STEC)
  • faecal norovirus, rotavirus tests
  • faecal B. cereus and C. perfringens toxin tests.

7 References:

8 Contacts:
• Public Health Unit contacts at:
  After hours: call above numbers, or paging service
  9214 8215

• Dr Jeremy McAnulty, Director Centre for Health Protection, NSW Health
  Phone: 9391-9192
  Email: jmcan@doh.health.nsw.gov.au

• Craig Shadbolt, Manager Foodborne Illness Investigation Unit, NSW Food Authority
  Phone 9741-4777
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• Dr Lisa Szabo, Chief Scientist, NSW Food Authority
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• Peter Howard, Senior Scientist, Enteric Reference Laboratory
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  Phone 98456255.
  Email: peter.howard@swahs.health.nsw.gov.au
APPENDIX 20. Standard guidelines: Post-mortem in sudden unexpected death in the young

Prepared for the Royal College of Pathologists of Australasia by the members of the Trans-Tasman Response AGAINst sudden Death in the Young (TRAGADY) group, April 2008

Background

Inherited cardiac diseases that predispose to sudden and unexpected death in young people are being increasingly recognised and managed with life-saving interventions. The impetus for this document arises from ongoing evidence of inadequate or inconsistent investigation of young sudden deaths, which results in failure to identify potentially fatal, yet treatable familial disease. The document has also been prompted by the collective experiences of family support groups in many regions, which reveal that surviving relatives find the post-mortem process hard to understand and that the communications between family members and medical and legal professionals are frequently inadequate from their perspective.

This document aims to assist pathologists and coroners in the delivery of good medical practice when faced with the challenge of investigating sudden and unexpected deaths, especially of young people. Local practice will vary in accordance with local legal ethical and cultural frameworks, particularly regarding issues such as consent, the retention of tissue or organs, and arranging genetic investigations. Parts of this document overlap with existing best practice guidelines for the investigation of sudden unexpected death in infancy (SUDI), in which the tests for metabolic, respiratory and infectious causes are more extensively described. Cross-reference with these documents is important, particularly for deaths occurring before the age of 2 years.

An adequately detailed investigation of sudden death in children and young adults can identify inherited cardiac disease in more than 40% of cases. For each of these diagnosed cases, an average of 9-10 high-risk relatives are identified. Increasingly, effective screening and therapy are available, which has the potential to reduce greatly the risk of future sudden deaths in this high risk group. However, the recognition of these disorders in the sudden death victim depends primarily on a detailed and thorough post-mortem examination, followed by expert evaluation of first degree relatives, which may include analysis of DNA. The inclusion of a mechanism to record and evaluate a high quality family history enables recognition of several conditions that typically escape detection during life but which can cause sudden death. These include long QT syndrome, Brugada syndrome and catecholaminergic polymorphic VT (CPVT), all of which may have a negative standard post mortem examination result.

Cases presenting with sudden unexpected death, particularly among those younger than 40 years of age, have an increased likelihood of an underlying major familial susceptibility. Medical practitioners and coroners, who may be under great pressure to avoid a post-mortem, must now respond to evidence that failure to identify these inherited disorders may result in missed opportunities to avert future premature deaths among other family members.

The process should aim to:
1. Examine all cases of sudden unexpected or unexplained death in the young (particularly in the age group of 0-40 yrs)
2. Investigate the possibility of familial disease
3. Educate, inform and communicate with the family in an open and timely manner.
4. Save DNA or other tissue to allow greater diagnostic accuracy either currently or in the future.
5. Preserve data and tissue to facilitate the prospect of future clinical diagnosis and research into causes of sudden death in accordance with local legal, ethical and cultural frameworks.
6. Use a multidisciplinary approach, which utilises the requisite specialist skills of allied clinical and scientific disciplines, to evaluate all available information likely to identify the underlying factor(s) responsible for the sudden and unexpected death.

7. Record sufficient diagnostic data from which the incidence of sudden death and related health trends can be determined.

**Definition of sudden unexpected death**

A death occurring suddenly, in an individual in whom death was unexpected.

“*Sudden*” implies death usually within 24 hours of the first symptom, or those resuscitated from cardiac arrest and dying during the same hospital admission. Most such deaths occur over a few seconds or minutes.

“*Unexpected*”. This refers to prior circumstances, particularly of someone who was believed to have been in good health or who had a stable chronic condition (e.g. hypertrophic or dilated cardiomyopathy, a neurological condition such as epilepsy, or a respiratory condition such as asthma), in whom sudden death was not expected. It also includes a sudden death occurring in the presence of an illness which would not be expected to cause death.

**Aims of investigation of sudden death victims**

To establish the cause and mechanism and manner of death, and in particular to:

1. Exclude an unnatural death

2. Ascertain the likely cause of death, for both accurate diagnostic coding and the information of surviving relatives

3. Identify any familial condition, if present, which might lead to the prevention of future premature deaths among other family members.

4. Provide accurate data for the inquiries into the incidence of remedial factors around sudden unexplained/unexpected deaths.

**Who should lead the investigation?**

The investigation, under the jurisdiction of the State and/or local Coroners, should be led by a pathologist with experience in the investigation of sudden death who has access to the infrastructure outlined below. This will usually be a forensic pathologist, but may also be an anatomical or other pathologist with appropriate forensic autopsy experience. In rural practice, liaison with a specialist centre is necessary to achieve a high diagnostic yield, and since findings may have important implications for surviving relatives, this liaison is strongly recommended. In cases of sudden unexpected death in children, involvement of a pathologist with paediatric experience is essential.

**Where should the post mortem investigation be performed?**

Where possible, the body should be transported to a specialist forensic pathology centre for investigation. If this is not possible, protocols should be established so that tissue samples are retained for future specialist examination, and as a minimum a 10-20ml blood sample in a plain tube kept in a freezer to -20º C for subsequent molecular or biochemical analysis. Alternatively a refrigerated sample in an EDTA tube can also be used to extract DNA from later. The pathologist should be familiar with local blood and tissue storage practices prior to dealing with such cases.

**Principles of the investigation**

1. All cases of sudden unexpected death in young people (0-40 years) should have an autopsy, and be examined and investigated under the same principles.

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1 It is important to remember that some unnatural deaths (e.g.: motor vehicle accidents, experienced swimmers drowning), could be triggered by an arrhythmia.
2. A full post-mortem examination should be completed (i.e. not limited to the heart.)
3. The investigation, ideally led by the pathologist, involves a team approach, including as a minimum:
   3.1 A person designated to liaise with the family
   3.2 Specialist cardiology involvement with the family when non-cardiac causes are excluded.
   3.3 Laboratories with molecular genetics, toxicology and metabolic expertise.
4. A detailed antecedent clinical history must be obtained.
5. A detailed and relevant family history must be obtained.
6. Liaison with the family should be established early and be ongoing until a cause of death is ascertained.
7. Skilled macroscopic and microscopic examination of the organs is required particularly of the heart (especially right ventricular muscle), and the brain. This may require some specimens to be examined by others.
8. Adequate histological material for review or referral if necessary must be obtained.
9. Tissue or blood suitable for DNA extraction must be obtained.
10. Results, including photography must be clearly documented.
11. Results must be described and annotated in a standard fashion which will allow epidemiological data gathering.
12. In cases where no cause is found, there is no standardised nomenclature to ascribe as the cause of death. However, “presumed cardiac arrhythmia” may fulfil legal and family requirements while leaving the option for later genetic and family investigation and diagnosis of conditions which may have implications for the family.

Suggested sequential autopsy examination
1. Obtain initial history including copies of witness, police, medical staff and ambulance reports.
2. Obtain further detailed history including details of the presenting event, relevant family and previous medical history.
3. Consider pre-autopsy imaging (CXR/CT/MRI/photography)
4. Carry out external examination
5. Exclude non-cardiac natural death (cerebral haemorrhage, aortic aneurysm, peptic ulcer, and pneumothorax)
6. Exclude macroscopic heart disease (ischaemic, valvular, cardiomyopathy, congenital anomalies, the origin and course of coronary arteries, and evidence of ARVC).
7. Obtain samples of myocardium and blood or spleen (frozen) suitable for DNA analysis (and also suitable for viral PCR). These are critical if post mortem is negative and if a potentially inherited disease is found.
8. Obtain blood and urine for toxicology screen (as a minimum)
9. If post mortem-negative or a cardiomyopathy is found, refer the family for specialist cardiological investigation and guided DNA investigations.
10. In cases where a metabolic condition is considered likely (e.g. preceding viral illness, period of starvation, nocturnal death, possibly with positive findings such as fatty liver), particularly in children under 2 years of age, further tissues should be preserved. Pathologists should be aware of their local centre policy for the investigation of potential metabolic disease and of sudden infant death syndrome, and be guided by this. Samples usually include blood on a newborn screening card, urine, and skin for fibroblast culture.

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2 To achieve this aim it may be necessary to explain to the next of kin potential benefits of a post mortem, including the detection of familial conditions, in cases where coronial investigation has not been ordered. Under these circumstances, a limited post mortem may be appropriate, along with securing a sample of blood or tissue adequate for DNA extraction.
3 Specialist cardiology involvement will be a multidisciplinary team with expertise in inherited cardiac disease, clinical and molecular genetics and cardiac arrhythmias; henceforth “Cardiac Genetic Service” (CGS).
4 Consultation with other specialist physicians or paediatricians, i.e. neurologists/clinical geneticists/SIDS experts is also encouraged according to findings from the clinical or family history, or the post mortem itself.
5 Such samples will allow genetic diagnostic tests either currently available or available in the future as a consequence of ongoing research. The length of time this tissue is preserved will depend on the local legal/ethical and cultural issues, and issues of consent. The coroner may instruct tissue is returned to the family prior to this occurring.
6 Aims in 9 and 10 can both be achieved by referral to CGS.
Clinical information relevant to the autopsy
A detailed clinical history and family history are an essential part of the investigation of sudden young death. The history taken by the police at the scene should be recorded with the aid of a structured questionnaire. As it is uncommon for police officers to have experience with recording these histories a recommended structured questionnaire is included in the appendix. This initial police report may be supplemented later by additional details obtained by a clinician or specially trained health assistant, or from medical records. A phone call to the deceased’s GP may also provide valuable information.

The key features to document

Circumstances of the death - Detailed review, date, time, place, and activity (at home, at rest or during exercise or emotional excitement). Document associated seizures, prodromal symptoms. Was the death witnessed? Were there any suspicious circumstances?

Past medical history - General health status such as previous significant illness or events, particularly seizures, epilepsy, faints, syncope, palpitations and respiratory or neurological disease. Review of medical history of deceased from family and/or physician. Retrieval of results of any investigations e.g. ECG, EEG, CT, MRI. Many patients with prior syncopal episode have been routed down a cardiac or a neurological investigation path.

Previous surgical procedures or interventions - Details of current medications, including cardiac drugs, but remember that many non-cardiac drugs are pro-arrhythmogenic (see: www.qtdrugs.org).
A history of competitive or habitual sport should be ascertained given that “athlete’s heart” may need to be considered as a cause of abnormal right and left ventricular morphology.

Family history of sudden premature death, or familial epilepsy, fainting or syncope (long QT syndrome, catecholamine polymorphic VT, and familial cardiomyopathy, amongst other cardiac conditions, have all been misdiagnosed as epilepsy)

ECG, serum enzymes, troponin estimations if done in life

Lipid profiles and related medication if known

Pre-autopsy
Consider imaging e.g. CXR, CT, MRI. (Any suggestion of pneumothorax?) As a minimum, total body X-Ray of:

a) All infants and children <2 years;
b) Trauma related deaths.

Weigh the heart and index to height/weight/aged (Index Table 1). Measure ventricular wall thickness- at least maximal septum, maximal posterior wall, LV mid cavity dimension (immediately basal to the anterior superior papillary muscle- and reference values to normative data (Index Tables 2-5); view and report valvular morphology and size, specific comment re aortic and mitral valve (e.g. MV prolapse) meticulous documentation of coronary arteries (origin, course, dominance, disease). Consider photography of heart even if “normal”.
If no macroscopic heart disease is found, as a minimum the samples described below should be retained. Formalin should be buffered with 10% phosphate to reduce the acidity which both degrades DNA, RNA and viral particles. Buffering also prevents formation of formalin pigment in the sections.

Microscopy/Histology
Histology results are often equivocal e.g. myocarditis, hypertrophic cardiomyopathy and ARVC may be over or under-diagnosed. In the diagnosis of inherited heart disease, molecular cardiology and family investigation may take primacy in achieving a final diagnosis.

**Histology sections**

*Left and right atria*[^1]

*Mitral valve* - if it appears abnormal

*Left ventricle* - mapped blocks of the anterior, lateral, septal and posterior regions.

*Right ventricular outflow and anterior free wall*

*Conduction system* - The pathologist should at least retain the AV node region.

*Pulmonary histology* to exclude pulmonary hypertension

![Diagram of heart sections](image)

**Suggested sampling site for LV and IVS sections**

Optimally, an entire ring of ventricular myocardium should be sampled, preferably at the level immediately caudal to the insertion of the papillary muscles. Additionally, grossly abnormal areas of myocardium, valves and coronary arteries should be sampled as a matter of course.

![Diagram of heart sections](image)

**Suggested sampling site for RV sections**

A strip of right ventricular myocardium, extending along the anterior wall of the RV from the pulmonary valve to the apex. Generally, there should be 3 to 4 sections of RV myocardium, which can be placed together in a single cassette.

H&E staining should be done as standard. Depending on what is seen, further stains may be appropriate, for example connective tissue stains (such as elastic van Gieson or Movat pentachrome) as well as Congo red (thick section) for amyloid, perls's prussian blue for iron and PAS/AB/PAS for storage disorders. If histology is suggestive of myocarditis, but results are inconclusive, the tissue should be referred for review and specialised tests (such as immunohistochemistry (CD3, CD20, CD68, etc)) at a specialist centre.

Note recent evidence that viral myocarditis and dilated cardiomyopathy can occur without histological evidence of viral infection, particularly with Parvovirus and Adenovirus. Viral PCR of myocardium is therefore recommended in every case when the heart is apparently normal- particularly when there is an antecedent history consistent with a recent viral infection, when histology is suspicious for myocarditis, and with dilated cardiomyopathies, looking for locally prevalent viruses, in particular Parvovirus B19.

[^1]: A section can be taken by cutting vertically through the left atrium, through the atrioventricular groove to the posterior wall of the left ventricle to include the mitral valve. Similarly, a section can be taken from the right atrium through the right ventricle at the infundibulum. This will likely include at least one section with an epicardial coronary artery.
enterovirus and adenovirus. Other viruses to consider include respiratory viruses (Influenza, parainfluenza, RSV) or human herpes viruses (EBV, CMV, HHV6 etc.)

Fresh cardiac tissue should be obtained at autopsy for investigation of possible viral myocarditis. Optimal specimen is approximately 0.3cm cube of ventricular tissue placed in a vial of aqueous tissue storage reagent capable of rapidly permeating tissues to stabilize and protect cellular RNA, such as RNAlater® and sent immediately to the virus reference laboratory. Ideally tissue should be kept at 4ºC and shipped chilled. If the history or pulmonary pathology suggests respiratory infection, take a piece of lung and put into same solution (different bottle!). Any ante-mortem blood should be kept and an EDTA tube full of blood should also be sent for viral studies.

If no cardiac (or other cause) is found at the time of autopsy, strongly consider a formal neuropathological examination.

**DNA**

Some blood or tissue must be saved for possible DNA extraction. Suitable samples include blood (whole frozen blood in a plain tube, or EDTA sample) myocardium and spleen or liver samples (snap deep frozen (-80º C)) or preserved in a tissue storage solution capable of protecting cellular RNA (“RNA later”). Blood spots on a neonatal (Guthrie) screening card may be insufficient. **Formalin fixed paraffin embedded tissue blocks may not be suitable for DNA extraction and should not be relied upon as the sole source of DNA.**

**BLOOD**

If ante mortem blood is available (e.g. taken during resuscitation) this is preferable, and efforts should be made early to ensure it is not destroyed (which often occurs 72 hours after the sample was received). If early myocardial infarction is suspected, consider cardiac troponin T (if death less than 6 hours prior). Toxicology (comprehensive) - biochemistry may be helpful with a history or family history of diabetes or coronary artery disease/atheroma.

**Post Autopsy**

Provisional results should be communicated early to family.

**Referral of family to an appropriate medical speciality team**

This will often be a cardiac genetic service (CGS) led by an experienced adult or paediatric cardiologist/electrophysiologist. A strong professional liaison between pathologist and cardiologist or other physician aids the process of gathering all relevant details, as well as offering effective support and management for the surviving relatives. The medical team ideally should have strong professional links with a regional clinical genetics service, where available, or have a person within the team with genetic counseling experience.

The pathologist should expect the CGS to take on the responsibility of coordinating appropriate clinical evaluation of relatives of the deceased. This may include arranging for mutation screening within specific genes on a DNA sample from the deceased after consultation with the pathologist and, if required, also with the coroner. It is strongly recommended that close family members understand the rationale for the proposed genetic investigations before they are ordered, and that the test outcomes, particularly the clinical interpretation of abnormal or equivocal results, are discussed directly with designated family member(s). The discussion of genetic results with relatives will be the responsibility of the clinician or pathologist who arranged the genetic investigation. As with all other specialist services, the family GP(s) should also be informed of the diagnostic process as it occurs, invited to add further medical or social history, as appropriate, as well as being included in the delivery of any follow-up support that may be required.
Algorithm to guide tissue preservation

**ESSENTIAL IN EVERY CASE**

- Histology of the myocardium
- Some tissue or blood suitable for DNA extraction e.g.: Blood, (Whole blood frozen to -20ºC in a standard freezer, or blood in an EDTA tube in a standard refrigerator), and/or Myocardium or Spleen (Either deep frozen (-70ºC) or in “RNA later”

**STRONGLY ADVISED**

- Cases with normal histology/myocarditis/dilated cardiomyopathy. Save myocardial tissue and blood for viral PCR. Fresh EDTA blood is preferable if it can be delivered promptly (2 days max) to the lab. Otherwise, frozen whole blood and/or frozen EDTA blood OK (label which is which). Myocardium in either “RNA later” or deep frozen.

- In cases with nocturnal death, a prodromal illness or a period of starvation, especially in young children (< 5 years): Samples for metabolic study (as per SIDS protocols-whole blood, as a Guthrie card, urine, skin for fibroblast culture (tissue culture medium initially at room temperature or 4ºC))

- In children with unexplained cardiac hypertrophy or unexplained cardiac dilation. Samples for metabolic/mitochondrial study [blood, liver, heart, skeletal muscles] (deep frozen -70ºC). Wrap the small tissue sample in foil and place in a small tube and put immediately into dry ice and store indefinitely at -70ºC. Record the time between death and the time of sampling.
APPENDIX 21. Standard guidelines: Recovery of skeletal remains

When skeletal remains are discovered, and once it has been determined that the bones are human, a number of specific procedures must be followed in order to discover the origin of the remains and whether they are of recent origin and require specific identification or of historical origin (usually classified as beyond living memory).

Where cases are clearly identified as being of historical Aboriginal origin all efforts should be made to avoid disturbance of the remains, the coroner should be notified and the local land council consulted.

For the purposes of a forensic investigation, a human bone represents a human body and until the investigation is completed, it must be treated with the cultural and scientific respect afforded to a complete body.

Until the distinction between recent and historic has been determined, the recovery site must be treated as a possible police investigation scene and appropriately protected. The police have a statutory responsibility to investigate the circumstances of such deaths. When skeletal remains are discovered, it is not always possible to make an immediate assessment of whether they are remnants of an historic grave site or the remains of a human who may have died under suspicious circumstances.

It may be necessary to establish a proper recovery grid of the site. This will involve the skills of archaeologists, the Forensic pathologist and other trained scene examiners and evidence recovery specialists. The number and types of scene specialists required will be determined by the nature of the site. Until it can be established that it is a recent burial the site is investigated with the extreme care with regard to the cultural sensitivity of the aboriginal people.

1. Indicators of “historic” remains

Remains may have been recovered from a known or historic site. Such sites are generally well documented. Valuable assistance can be gained from local Aboriginal land councils, Parks and Wildlife Service, district councils and museums.

Important indicators of historic remains include the following.

- Evidence of multiple remains from several individuals.
- Bones will be dry and discoloured with loss of periosteum.
- Exposure of remains may be scattered due to erosion of an ancient site.
- There may be remnants of customary burial artefacts, tomb remnants or caskets.
- There may be anthropological features of Aboriginal bones (skull and jaw).
- Teeth may show advanced wear due to grinding of their occlusal surfaces.

2. Indicators of “recent burial”

- Bones may be associated with remnants of clothing other than burial garments.
- The skeleton may be largely intact rather than scattered.
- Bones may not be concealed or apparently buried.
- Soft tissue remnants may be present, including periosteum.
- The weight and waxiness of the bone may indicate recent death.
- No grinding of teeth.
- Not a known burial site.
3. **Examination of skeletal remains**

The purpose of this examination is to determine the sex, height and stature, chronological age, and race of the deceased, and the cause of death. Reference to standard forensic anthropology texts will be essential in order to adequately make these determinations.

- **Sex determination** – skull, pelvis and femur are the most useful bones for sex identification.
- **Height and stature** – the lengths of pairs of long bones are measured and then height is calculated using standard formulae, such as those of Trotter and Gleser. Stature and general build can be estimated from muscle markings, etc.
- **Chronological weight** can be based on ossification centres and fusion of epiphyses up to the age of 25 yrs. Articular surfaces of symphysis pubis, cranial suture union, etc. may help, but after 30 years of age accurate age determination is difficult.
- **Racial characteristics** for the skull and particularly the mandible may assist.

Although the conditions of burial will significantly affect the ageing process, dating of skeletal remains may be based on the following:
- Tendons and ligaments often persist for up to 5 years.
- There is a loss of periosteum after 5 years.
- Fluorescence of cut surface of long bones indicates presence of protein in matrix and an age of less than 50 years.
- Protein analysis can also be used, as proteins are lost with time since death.
- Presence of strontium-90 indicates death after 1950.
- Effervescence of cut surfaces by application of acid indicates replacement of protein with carbon salts suggesting an age of over 100 years.
- Radiocarbon dating if more than 200 years.

4. **Cause of death**

Stab wounds in bone, skull fractures, bullet holes, multiple fractures from falls or impacts, bone disease, etc.

Identification may be carried out by forensic odontology, radiology, frontal sinus, craniofacial superimposition, DNA and other skeletal characteristics.

5. **Possible outcomes**

**Homicide**

- Coroner’s case.
- Police inquiry commenced.
- Containment of scene continued.
- Pathologist’s examination carried out in accordance with standard protocols.

**Recent non-criminal case**

- Coroner’s case.
- Pathologist’s examination completed.
- Body released to funeral directors.

**Non-suspicious historic find**

- Contact coroner who will liaise with local land council.
- Discussion with national parks and wildlife archaeologist.
APPENDIX 22. Special dissection techniques

As far as possible, all special dissections should be performed in a bloodless field. Therefore, the brain should be removed before neck dissection, and in pelvic dissections the pelvis should be elevated after the thoracic and abdominal organs have been removed by placing a block under the lumbar vertebra. Representative sections from all areas of injury should be taken and labelled specifically for the site of origin. It is also important that photographs should be taken at all stages of these dissections and that the autopsy report reflects the nature and extent of the special dissections that have been performed.

1. Anterior neck dissection

This should be performed in all cases of suspected neck injury.

- The skin should be reflected to expose the sterno-mastoid muscles and the external jugular veins. This is best achieved with lateral neck incisions extending from the mastoid processes vertically downwards and then carried anteriorly and medially below the sterno-clavicular joints to the midline below the manubrium. In many jurisdictions, such incisions are unacceptable and it may be necessary to perform the traditional Y-shaped incision from the front of the shoulder to the sternum. In cases of severe obesity, this will not allow a good exposure of the higher anterior neck structures. The other traditional opening incision under the breasts should not be used for careful neck dissection.
- Layer-by-layer dissection of the neck musculature in situ should commence with reflection of the sternomastoid muscles and by incising their sternal and clavicular insertions. The omohyoid, sternohyoid and sternothyroid muscles should then be removed to expose the thyroid gland.
- Next, the thyroid gland should be removed to expose the cricothyroid muscle. Any bruising or injury to the hyoid bone or laryngeal cartilages should be noted and sampled.
- Next, identify the common carotid arteries and their bifurcations and note any associated adventitial bruising or haemorrhage.
- Incise the digastric muscles, free the tongue from the mandible and remove the neck structures by retracting on the tongue. Do not hold or compress the laryngeal structures.
- Finally, note any injury or bruising on the posterior pharyngeal or laryngeal structures or on the anterior surface of the cervical vertebrae.

2. Posterior neck dissection

This is a valuable technique to examine for posterior neck injury or to expose the vertebral arteries either for angiography or for evidence of traumatic subarachnoid haemorrhage.

- Expose the posterior neck musculature by making a vertical midline posterior incision with bilateral extensions at the level of the occipital protuberance.
- Perform a layer-by-layer dissection from above downwards cutting the splenius capitis, the semispinalis capitis, the posterior insertion of the sternocleidomastoid muscle and the trapezius.
- The vertebral arteries are seen within a deep triangle formed by the superior oblique muscle laterally, the rectus capitis posterior major medially and the upper border of the posterior arch of the atlas with the inferior oblique muscle covering the lower border of this bony arch.
- The 1st cervical nerve may be seen immediately below the vertebral artery crossing the upper border of the posterior arch of the atlas.

It is a difficult dissection and if the body has been lying on its back for some time after death, the tissues may be oedematous and very congested due to lividity. If necessary, leave the body on its front for at least 30 minutes after dissecting the skin before continuing to expose the deeper neck structures.
3. Facial dissection

In cases of suspected smothering, facial fractures or other facial injury, this technique allows for a good demonstration of the extent of injury in the periorbital or maxillary areas. It also allows for the reconstruction of the facial tissues after dissection without significant disfigurement.

- Dissect only one side of the face at a time.
- Join the inferior ends of the coronal scalp incisions to the upper lateral extensions of the chest incisions.
- Dissect forwards, incising the external auditory canal. In a vertical plane dissect off the skin to expose the parotid gland and the zygomatic arch and then dissect anteriorally, superficial to the fatty tissue over the facial musculature.
- Carefully enucleate the eye from behind the skin flap, taking great care not to buttonhole the eyelids or to perforate the eyeball.
- Dissect along the margin of the mandible to the midline and dissect off the lips by cutting through the buccal mucosa behind the skin flap.
- Complete the dissection by exposing the lateral aspects of the nasal bones and nasal cartilage.
- It is most important that the lateral dissection should not be extended across the midline to allow for a vertical line of fixation of the facial structures essential for the reconstruction of the face without disfigurement.

4. Pelvic dissection

This technique may be considered in cases of alleged pelvic injury, rape or anal penetration and in the investigation of maternal deaths where uterine injury is suspected. Using this technique it is possible to see and photograph not only mucosal injuries to the vagina and rectum and their relationship to the uterus and adnexae, but also peri-vaginal and peri-rectal injuries and injuries to the sphincters and the muscle floor of the pelvis. Speculum examination alone does not provide this degree of visualisation.

- Prior to any dissection, examine and photograph the introitus carefully under good light, looking for injuries and foreign material, take appropriate swabs, smears and pubic combings.
- Consider examination using a culposcope, speculum or dissecting/dental microscope.
- In order to ensure a bloodless field, all of the internal organs except the pelvic organs should be removed and the pelvis should be elevated by placing a block under the sacrum.
- Make a diamond-shaped incision in the skin of the perineum to encompass the vagina/rectum or base of penis/rectum and reflect laterally to expose the symphysis pubis and pubic rami.
- With a scalpel cut through the symphysis pubis. This will expose the bladder and urethra intact.
- Open the urethra into the bladder and then dissect off the bladder and urethra to expose the anterior wall of the vagina.
- Dissect around and remove the block including the vagina, uterus and rectum from the bladder and pelvic muscles.
- Visualize the state of the hymen and any old or recent vaginal injuries. It is also possible to take additional vaginal swabs if necessary.
- Inspect and then open the vagina avoiding apparent areas of mucosal damage and expose the cervix.
- Open the anus and rectum.
- Document, photograph and histologically sample any apparent injuries.
APPENDIX 23. Autopsy Report Audit Form

1st Quart. 2nd Quart. 3rd Quart. 4th Quart.

Case No ....................

Pathologist ..............................

Name, age, sex, correctly recorded  Yes  No

If not, error is ...............................................................

Date/Time of Autopsy correctly recorded  Yes  No

If not, error is ...............................................................

External examination includes:

- identification features  Yes  No
- medical interventions (where appropriate)  Yes  No
- recent injuries (where appropriate)  Yes  No

Internal examination includes mention or description of organs in the following systems:

- CNS  Yes  No
- CVS  Yes  No
- Resp.S  Yes  No
- GIS  Yes  No
- GUS  Yes  No
- Retic. ES  Yes  No
- EndoS  Yes  No
- Musc-Skel  Yes  No
Specimen collected as required by case history | Yes | No
---|---|---
Results of further tests included in or with report | Yes | No
Cause of death internally appropriate | Yes | No
Cause of death consistent with findings | Yes | No
Comments included in report | Yes | No
Comments clearly expressed | Yes | No

Comments consistent with factual contents of report | Yes | No
Comments relevant to the circumstances of the death | Yes | No
Final classification completed | Yes | No
Final classification appropriate to findings | Yes | No

Date of Provisional Report
Date of Final Report
Report signed/released within days

Time frame appropriate for nature of case | Yes | No

CASE SUBJECT TO SPECIFIC STANDARD PROTOCOL | Yes | No

Overall case standard | satisfactory | unsatisfactory

If unsatisfactory, state reasons and document actions taken:
## APPENDIX 24. Specimen referral guidelines

<table>
<thead>
<tr>
<th>Recommended guidelines</th>
<th>By Whom</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Referring pathologist contacts the Forensic Pathology Service to decide course of action.</td>
<td>Referring pathologist</td>
</tr>
<tr>
<td>2 Photographs of gross specimens are taken prior to dispatch to document the nature of the sample and any important features. A copy is held by the referring pathologist A referral letter accompanies the specimen. Referring pathologist holds a copy.</td>
<td>Referring pathologist</td>
</tr>
<tr>
<td>3 Referring laboratory contacts the receiving laboratory to obtain details for packaging and shipping. An instruction sheet containing the following information will be provided by return fax or email: All samples to be labelled with unique identifiers on the primary packaging containing the sample. Transportation box to be clearly labelled with shipper (sender) and consignee (receiver). Outer packaging (transportation box and/or courier bag) to meet labelling requirements for local Infectious Substances Shipping Guidelines. Parcel is sent through track-and-trace signed courier system. Packing slip details all contents of the parcel. (The receiving lab will fax this back as part of receipt process in laboratory).</td>
<td>Referring laboratory</td>
</tr>
<tr>
<td>4 Formal notification of dispatch details are sent by email or fax by the sender to the receiving pathologist. Details to include: address as recorded on the package; time of dispatch; place of dispatch; courier or mail service used; estimated time of arrival; and contact telephone, fax/email of sender.</td>
<td>Referring laboratory</td>
</tr>
<tr>
<td>5 Formal notification of specimen dispatch details as above are communicated to the receiving specimen reception area.</td>
<td>Receiving pathologist or designate</td>
</tr>
<tr>
<td>6 Formal notification of specimen receipt is communicated back to the contact sender, whose name is provided on the package – faxed copy of the packing slip by the person who is opening and checking the parcel contents.</td>
<td>Receiving laboratory</td>
</tr>
<tr>
<td>7 Specimens are logged at the time of arrival at the receiving laboratory. The following shall be recorded: the courier tracking number; sender details; recipient details; signature of staff member receipting; and time of receipt.</td>
<td>Receiving laboratory</td>
</tr>
<tr>
<td>8 Internal transfer of Forensic Pathology specimens is logged and signed.</td>
<td>Receiving laboratory</td>
</tr>
</tbody>
</table>
APPENDIX 25.  Virology referral guidelines

Virology referral should generally be to SEALS at Randwick. Contact the Virology Department on 02 93829113 if you are sending specimens.

Urgent specimens should be notified to 02 93829133

Tests must be requested on a standard pathology referral form.

- When multiplex PCR (mPCR) tests are done, the relevant (requested) negative results will be reported. Any viruses tested within the mPCR that were not requested will not be reported if negative, but will be reported if positive.
- The tests done in the VDL are routine, and done usually daily, weekly or fortnightly. The research tests are done in the Virology Research Laboratory (VRL) and can be done only on specific request, as they are funded through research.
- Samples will be tested as pools (eg left and right lung swabs will be pooled together) and then, if positive, will be tested separately. If there is a possible impact upon sensitivity (eg large amounts of foreign material in a sample) samples will be tested individually.
- Where multiple specimens are received (eg lung swab and lung biopsy) then the specimen most likely to give a positive result (eg lung swab) will be tested. If positive, the matching specimen (eg lung biopsy) will also be tested. If DOFM Glebe indicates a request for all specimens to be tested for a specific case, this will be done.

SIDS and SUDI testing

The tests on tissue are around the likely or known causes of death.

1. mPCR SIDS VDL: CMV, HSV1, HSV-2, Parovirus, Toxoplasma
2. mPCR SIDS in VRL: Mycoplasma genitalium, M. hominis, Ureaplasma parvum, U. urealyticum
3. Bacterial testing done by culture, although VRL has mPCR available for T. pallidum, Trichomonas vaginalis, Gardnerella vaginalis

Respiratory infections

These are dependent to some extent upon season – clearly influenza is more frequent in temperate climates in winter, and is usually tested daily.

1. mPCR influenza: Influenza A (all types), influenza B (all types)
2. Subtyping assays for influenza: Currently subtypes A/H1N1/pandemic strain, A/H3 strains
3. mPCR RV1 is done in VRL, not VDL: M. pneumonia, C. psittacosis, C. pneumonia, M. tuberculosis

4. mPCR RV2: hMPV, hRV, Influenza A/B, Parainfluenza 1,2,3, RSV

Infections in immunosuppressed individuals

These are highly variable, and depend very much upon the clinical setting.

1. mPCR VDL05: Enteroviruses, VZV, HSV-1, HSV-2, CMV, EBV
2. BK/JC polyomaviruses: BK, JC
3. Adenoviruses: done infrequently as less sensitive than other mPCR. Involves subtyping of adenovirus at the time of testing.
4. Mycobacterium tuberculosis complex: done using commercial assays
5. HIV, HCV and HBV are all done using commercial assays for detection (qualitative) and quantitation (using real time, commercial PCR)