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CONTACT WEBSITES

British Neuropathological Society
www.bns.org.uk

Confidential Enquiry into Stillbirths and Deaths in Infancy
www.cesdi.org.uk

Institute of Biomedical Science
www.ibms.org

National Confidential Enquiry into Perioperative Deaths
www.ncepod.org.uk

National Sentinel Clinical Audit of Epilepsy-Related Death
www.official-documents.co.uk/document/reps/nscaerd/report.pdf

The Royal College of Pathologists
www.rcpath.org

The Royal Institute of Public Health
www.riph.org.uk

UK Confidential Enquiries into Maternal Deaths
www.doh.gov.uk/cmo/mdeaths.htm

In future, Confidential Enquiries will be organised under the **National Institute of Clinical Excellence**
www.nice.org.uk

APPENDICES

A1 Hazard Group 3 pathogens

A1.1 Viruses

Hepatitis C and B viruses; Human immunodeficiency viruses types 1 and 2 (HIV)
Dengue; Hantavirus spp: Hantaan HF with renal syndrome; Sin Nombre; Seoul; rabies; yellow fever; Rift Valley fever; Chikungunya
Unconventional agents: Creutzfeldt-Jacob disease (CJD) and other related transmissible spongiform encephalopathies

A1.2 Bacteria

Brucella spp; Bacillus anthracis; Burkholdia spp; Coxiella burnetii;
Mycobacterium tuberculosis; M. avium-intracellulare and other non-TB agents (in practice not a risk to health care workers since they are ubiquitous in air)
M. leprae (not a significant risk in practice)
Rickettsia spp; Salmonella typhi; Yersinia pestis

A1.3 Fungi

Histoplasma capsulatum; Coccidioides immitis; Paracoccidioides braziliensis; Penicillium marneffei.
(In practice, the actual phase of life cycle in man that may be encountered at autopsy is not the infective phase, rendering these infections less hazardous than in laboratory culture.)

A1.4 Parasites

Echinococcus spp; Leishmania braziliensis and L. donovani; Naegleria fowleri;
Plasmodium falciparum; Trypanosoma spp
(In practice, the actual phase of life cycle in man that may be encountered at autopsy is not the infective phase, rendering these infections less hazardous than in laboratory culture.)

A2 Guidelines for assessing presence of Hazard Group 4 pathogens in a cadaver

A2.1 Blood from the patient, taken before or after death, is to be tested for the main viral haemorrhagic fevers (VHFs), dengue, yellow fever, falciparum malaria, Nipah virus and leptospirosis. The Public Health Laboratory Service (Colindale) and Centre for Applied Microbiological Research (Porton Down) laboratories can do this in a working day if the samples are couriered. The geographical history of the patient is important in determining whether the patient could realistically have acquired a VHF or the other infections that clinically mimic VHF (malaria, leptospirosis, dengue, Nipah).

A2.2 If these tests show absence of the viral infections but presence of falciparum malaria or leptospirosis, then the autopsy is safe to perform under standard conditions.

A2.3 If Nipah virus infection is demonstrated, referral to a specialist centre can be considered or the autopsy not done.

A2.4 If dengue or yellow fever virus infection is demonstrated, the autopsy can be done under enhanced HG#3 conditions (i.e. as for HIV infection).

A2.5 If a VHF is confirmed, then the autopsy is not done.

A3 Protocols for performing post-mortem examinations on known or suspect 'high-risk' infected cadavers: Hazard Group 3 infections HIV, hepatitis C, tuberculosis, Creutzfeldt-Jakob disease

A3.1 HIV/AIDS

1. NAME OF INFECTION
   HIV-1 and HIV-2

2. RISK AT AUTOPSY
   Acquisition of viral infection, AIDS
   Associated infections in HIV-infected cadavers: tuberculosis, HBV, HCV

3. DOES INFECTIOUSNESS OF CADAVERS DECLINE OVER TIME
   Yes, but infection documented up to 16 days after death. Therefore assume always infectious
   Note: patients treated effectively with anti-retroviral therapy frequently have a blood HIV viral load below the limits of detection (<50 copies/ml). Although the risk of infection from such patients through an accident during an autopsy is therefore exceedingly low, the autopsy protocols should be the same as for those patients with known high viral loads or unknown viral load

4. MODES OF ACQUISITION
   Percutaneous injury, mucosal contamination, skin contamination

5. RISK OF ACQUISITION OF INFECTION
   Percutaneous injury: 0.3% risk of infection (without PEP – see point 33 below)
   Mucosal contamination: 0.03% risk
   Skin contamination: uncertain, but has occurred through broken skin in nursing environment
   To date, one pathologist known to have contracted HIV from percutaneous injury whilst performing a post-mortem (removing the scalp)

6. WHO IS PROSECTOR
   Consultant histopathologist or experienced junior pathologist

7. WHO IS ASSISTANT APT
   Diplomate in Anatomical Pathology Technology, i.e. MTO2 grade or higher

8. NEED FOR CIRCULATOR
   Ideally yes, but not essential

9. OTHER PEOPLE PERMITTED IN AUTOPSY ROOM AT SAME TIME
   Yes, but at distance from blood splash contamination

10. PREVIOUS STAFF VACCINATIONS
    BCG, HBV are essential

11. ESSENTIAL TO USE SEPARATE 'HIGH-RISK SUITE' IN MORTUARY
    No, but the mortuary must have adequate ventilation, water supply and drainage; a separate suite is desirable

12. CLOTHING FOR PROSECTOR AND ASSISTANT APT
Standard: scrub suits, disposable waterproof gown that covers the arms, disposable plastic apron covering the tops of boots, rubber boots, hat

13. RESPIRATORY PROTECTION
Surgical mask to prevent oral/nasal contamination
If tuberculosis is known or seriously suspected: a visor with ventilation, or a special filter mask (see A3.3, Protocol for tuberculosis)

14. EYE PROTECTION
Wide-area glasses or goggles or visor essential

15. GLOVES
Two layers essential: option – neoprene cut-resistant gloves plus latex – this is now standard and the preferred option. The best possible protection is a triple glove sandwich of latex-neoprene-latex, so that if the outer glove is punctured it is not necessary to stop working to change the glove, yet the skin is completely protected. Consider chain-mail glove over the latex glove on the non-saw hand when removing the skull

16. POST-MORTEM TO BE PERFORMED IN BODY BAG
No

17. TOOLS FOR DISSECTION AND ORGAN EXAMINATION
Standard, but minimum with sharp points
Blunt-ended PM40 and scalpel blades are available

18. POST-MORTEM LIMITED TO CERTAIN ORGANS
No

19. 'NON-STANDARD' ORGANS TO BE EXAMINED (best practice)
Eyes and spinal cord if clinically relevant (e.g. CMV), subject to appropriate consent

20. BRAIN EXAMINATION
Fix for 2–3 weeks before cutting, subject to appropriate consent from the Coroner or appropriate consent from relatives

21. SPECIFIC ORGANS OR PARTS THAT MUST BE EXAMINED FOR CASE ASCERTAINMENT
None

22. SPECIAL PRECAUTIONS IN REMOVING ORGANS
None, save care with sharp bone edges

23. HOW TO SEW UP CADAVER
Standard twine or clips

24. FIXATIVE FOR STANDARD HISTOLOGY
Formalin – kills HIV rapidly; brain disinfected by two weeks in formalin

25. FRESH TISSUE SAMPLES AND DESTINATION
For microbiology if necessary (e.g. suspected TB, mycosis, septicaemia)

26. DISPOSAL OF TISSUES NOT REPLACED IN CADAVER
Incineration

27. FATE OF INSTRUMENTS USED IN DISSECTION
Standard cleaning and decontamination

28. SPECIAL SURFACE DECONTAMINATION AND CLEANING REQUIREMENTS
None – standard cleaning procedures

29. NEED TO NOTIFY UNDERTAKERS OF RISK OF INFECTION
Yes

30. NOTIFICATION OF INFECTIOUS AUTOPSY CASE TO OTHERS
No, but keep secure register in mortuary for health and safety purposes, i.e. note HIV-infected status in the routine autopsy register book
If a new diagnosis of HIV is made at autopsy, the laboratory that performs the serology will routinely notify the Public Health Laboratory Service Communicable Diseases Surveillance Unit of the case

31. SPECIAL PRECAUTIONS FOR PROCESSING TISSUES AFTER ROUTINE FORMALIN FIXATION
None

32. HISTOPATHOLOGY BIOMEDICAL SCIENTISTS WHO MAY PREPARE MICROSCOPY SLIDES
No limitation

33. WHAT TO DO IF EXPOSURE OCCURS
The hospital's occupational health (OH) units have protocols for dealing with occupational exposure to HIV, access to appropriate post-exposure prophylaxis chemotherapy (PEP) and counselling. (PEP appears to significantly reduce risk of infection after percutaneous exposure)

If incident (percutaneous injury) occurs, stop the post-mortem and report immediately to OH.

In a public mortuary setting, there should be protocols for obtaining rapid local advice, and PEP if considered appropriate

A3.2 HEPATITIS C VIRUS

1. NAME OF INFECTION
Hepatitis C virus (HCV)

2. RISK AT AUTOPSY
Acquisition of HCV infection, with consequent risk of developing cirrhosis or hepatocellular carcinoma (about 50% risk by 30 years)
A proportion of HCV-infected cadavers are co-infected with HIV (see A3.1, Protocol for HIV/AIDS)
Up to 70% of IV drug users in London are HCV-infected

3. DOES INFECTIOUSNESS OF CADAVERS DECLINE OVER TIME?
Yes, but not significantly – assume always infectious

4. MODES OF ACQUISITION
Percutaneous injury is the only significant mode. Inhalation, mucosal and cutaneous exposure are not a significant hazard

5. RISK OF ACQUISITION OF INFECTION
3% likelihood following a needlestick injury, therefore probably similar following a cut

6. WHO IS PROSECTOR
Consultant pathologist or experienced junior pathologist

7. WHO IS ASSISTANT APT
Diplomate mortuary technical officer, i.e. MTO2 grade or higher

8. NEED FOR CIRCULATOR
Ideally yes, but not essential

9. OTHER PEOPLE PERMITTED IN AUTOPSY ROOM AT SAME TIME
Yes

10. PREVIOUS STAFF VACCINATIONS
BCG, HBV essential

11. ESSENTIAL TO USE SEPARATE 'HIGH-RISK SUITE' IN MORTUARY
Ideal, but not essential

12. CLOTHING FOR PROSECTOR AND ASSISTANT APT
Standard

13. RESPIRATORY PROTECTION
Standard surgical mask is sufficient

14. EYE PROTECTION
Glasses or goggles to be worn

15. GLOVES
Two layers essential: option – neoprene cut-resistant gloves plus latex – this is now standard and the preferred option. The best possible protection is a triple glove sandwich of latex-neoprene-latex, so that if the outer glove is punctured it is not necessary to stop working to change the glove, yet the skin is completely protected. Consider chain-mail glove over the latex glove on the non-saw hand when removing the skull

16. POST-MORTEM TO BE PERFORMED IN BODY BAG
No

17. TOOLS FOR DISSECTION AND ORGAN EXAMINATION
Standard

18. POST-MORTEM LIMITED TO CERTAIN ORGANS
No

19. 'NON-STANDARD' ORGANS TO BE EXAMINED
None

20. SPECIAL PRECAUTIONS IN REMOVING ORGANS
None, save care with sharp bone edges

21. HOW TO SEW UP CADAVER
Twine or clips

22. FIXATIVE FOR STANDARD HISTOLOGY
Formalin – kills HCV

23. FRESH TISSUE SAMPLES AND DESTINATION
Not necessary

24. DISPOSAL OF TISSUES NOT REPLACED IN CADAVER
Incineration

25. FATE OF INSTRUMENTS USED IN DISSECTION
Standard cleaning and decontamination

26. SPECIAL SURFACE DECONTAMINATION AND CLEANING REQUIREMENTS
Standard cleaning

27. NEED TO NOTIFY UNDERTAKERS OF RISK OF INFECTION
Yes

28. NOTIFICATION OF INFECTIOUS AUTOPSY CASE TO OTHERS
Not needed unless the autopsy is making a new diagnosis of HCV: the local consultant in communicable disease control must be informed, directly or via the Coroner, and appropriate contact tracing thereby instigated (see Appendix 4, Notification of infectious diseases). The hospital's infection control department should also be informed

29. SPECIAL PRECAUTIONS FOR PROCESSING TISSUES AFTER ROUTINE FORMALIN FIXATION
None

30. HISTOPATHOLOGY BIOMEDICAL SCIENTISTS WHO MAY PREPARE MICROSCOPY SLIDES
No limitation

31. WHAT TO DO IF EXPOSURE OCCURS
Stop the autopsy; clean the skin wound thoroughly; notify the hospital's occupational health department

A3.3 TUBERCULOSIS

1. NAME OF INFECTION
Mycobacterium tuberculosis
The other commonly encountered mycobacteria in hospital patients – M. avium-intracellulare, M. kansasii, etc. – do not present a hazard in the autopsy environment and do not require protocols different from the routine autopsy.

2. RISK AT AUTOPSY
Acquisition of tuberculosis. Most strains are drug-sensitive; but a small proportion of TB cadavers encountered in this mortuary will be known, suspected (not yet proven) or possible (i.e. possible from contact history) multi-drug-resistant strains. Both strains are equivalently infectious
A significant proportion of TB-infected cadavers will be co-infected with HIV (see A3.1, Protocol for HIV/AIDS if that is the case)

3. DOES INFECTIOUSNESS OF CADAVERS DECLINE OVER TIME?
Not significantly

4. MODES OF ACQUISITION
Inhalation of mycobacteria from tissues; percutaneous injury; mucosal contamination

5. RISK OF ACQUISITION OF INFECTION
Inhalation: variable, there have been small epidemics of TB among previously uninfected and non-BCG-vaccinated staff and students, attributable to acquisition from autopsy
Percutaneous injury – it is recorded ('prosector's wart')

6. WHO IS PROSECTOR
Consultant pathologist or experienced junior pathologist

7. WHO IS ASSISTANT APT
Certificated mortuary technical officer, i.e. MTO1 grade or higher

8. NEED FOR CIRCULATOR
Not essential

9. OTHER PEOPLE PERMITTED IN AUTOPSY ROOM AT SAME TIME
Only if wearing appropriate respiratory protection (see below)

10. PREVIOUS STAFF VACCINATIONS
BCG, HBV essential

11. ESSENTIAL TO USE SEPARATE 'HIGH-RISK SUITE' IN MORTUARY
Not essential, but preferable

12. CLOTHING FOR PROSECTOR AND ASSISTANT APT
Standard

13. RESPIRATORY PROTECTION
Ordinary surgical mask is inadequate. Must wear either microfilter face mask such as Tecnol 95 mask, or equivalent tight fitting mask with filter, or visor with ventilation.

14. EYE PROTECTION
Glasses, goggles or visor essential

15. GLOVES
Two layers essential; the best option is neoprene cut-resistant glove under latex

16. POST-MORTEM TO BE PERFORMED IN BODY BAG
No

17. TOOLS FOR DISSECTION AND ORGAN EXAMINATION
Standard, but minimum with sharp points

18. SPECIAL PRECAUTIONS IN REMOVING ORGANS
Care with sharp bone edges on ribcage
Filling the lungs via the bronchi with formalin – and completing the autopsy the next day – is not recommended or required; it does not sterilise the lungs nor disseminated TB lesions. Do the autopsy in standard fashion with appropriate respiratory protection

19. HOW TO SEW UP CADAVER
Standard twine or clips

20. FIXATIVE FOR STANDARD HISTOLOGY
Formalin – kills Mycobacterium tuberculosis of all strains

21. FRESH TISSUE SAMPLES AND DESTINATION
Sample of tuberculous tissue to microbiology/infection department for culture confirmation, resistance determination, molecular typing and archiving – whether patient comes from hospital or outside

22. DISPOSAL OF TISSUES NOT REPLACED IN CADAVER
Incineration

23. FATE OF INSTRUMENTS USED IN DISSECTION
Standard cleaning and decontamination

24. SPECIAL SURFACE DECONTAMINATION AND CLEANING REQUIREMENTS
None

25. NEED TO NOTIFY UNDERTAKERS OF RISK OF INFECTION
Yes

26. NOTIFICATION OF INFECTIOUS AUTOPSY CASE TO OTHERS
Not needed for known drug-sensitive TB strains. If known or suspected drug-resistant strain, the hospital's occupational health (OH) unit should be informed, along with the infection control department
If the autopsy is making a new diagnosis of TB, the local consultant in communicable disease control must be informed, directly or via the Coroner, and appropriate contact tracing thereby instigated (see Appendix 4, Notification of infectious diseases). The hospital's infection control department should also be informed

27. SPECIAL PRECAUTIONS FOR PROCESSING TISSUES AFTER ROUTINE FORMALIN FIXATION
None

28. HISTOPATHOLOGY BIOMEDICAL SCIENTISTS WHO MAY PREPARE MICROSCOPY SLIDES
No limitation

29. WHAT TO DO IF EXPOSURE OCCURS
Inhalation exposure is reduced to the minimum by these protocols. If a previously unsuspected cadaver is later determined to have active TB infection (i.e. multibacillary lesions or typical AFB-neg lesions preferably with culture proof) and full respiratory protection was not used, notify OH of the incident. Include names of the assisting APTs and other staff present in the autopsy suite at time of autopsy. Also in previously unknown cases, the infection control department must be informed

Percutaneous exposure: wash the lesion thoroughly, and later notify OH (as with all percutaneous injuries at autopsy that generate bleeding)

A3.4 CREUTZFELDT-JAKOB DISEASE

1. NAME OF INFECTION
Creutzfeldt-Jakob disease (CJD) is a member of the group of disorders known as transmissible spongiform encephalopathies. Those encountered in humans are sporadic, variant, iatrogenic and familial CJD; Gerstmann-Straussler-Scheinker, familial fatal insomnia and kuru. 'CJD' is used in this section to include all of these disorders

2. RISK AT AUTOPSY
Acquisition of CJD

3. DOES INFECTIOUSNESS OF CADAVERS DECLINE OVER TIME
Not significantly

4. MODES OF ACQUISITION
Percutaneous injury; mucosal contamination

5. RISK OF ACQUISITION OF INFECTION
There is a theoretical risk. There are no recorded cases of CJD acquired at autopsy, but some patients have been infected through inoculation using surgical instruments
Percutaneous exposure will not occur if steel mesh undergloves are worn
Full face visor eliminates mucosal contamination

6. WHO IS PROSECTOR
Consultant pathologist

7. WHO IS ASSISTANT APT
Diplomate mortuary technical officer, i.e. MTO2 grade or higher

8. NEED FOR CIRCULATOR
Ideal, but not essential

9. OTHER PEOPLE PERMITTED IN AUTOPSY ROOM AT SAME TIME
No

10. PREVIOUS STAFF VACCINATIONS
None available.

11. ESSENTIAL TO USE SEPARATE 'HIGH RISK SUITE' IN MORTUARY
Not essential but preferable

12. CLOTHING FOR PROSECTOR AND ASSISTANT APT
Disposable gowns and aprons

13. RESPIRATORY PROTECTION
None required beyond a standard face mask

14. EYE PROTECTION
Full face visor essential

15. GLOVES
Steel mesh gloves under latex when removing the skull, brain and spinal cord. Cut-resistant gloves, as for other HG#3 infectious autopsies, appropriate for the rest of the internal dissection

16. POST-MORTEM TO BE PERFORMED IN BODY BAG
Yes

17. TOOLS FOR DISSECTION AND ORGAN EXAMINATION
Disposable instruments as far as possible

18. POST-MORTEM LIMITED TO CERTAIN ORGANS
No; apart from the useful gathering of further information about CJD, the suspected clinical diagnosis may be incorrect and visceral lesions be the correct cause of death

19. 'NON-STANDARD' ORGANS TO BE EXAMINED
Spinal cord

20. BRAIN EXAMINATION
After fixation

21. SPECIFIC ORGANS OR PARTS THAT MUST BE EXAMINED FOR CASE ASCERTAINMENT
Yes – brain

22. SPECIAL PRECAUTIONS IN REMOVING ORGANS
Minimise environmental contaminations. If possible, remove brain with head enclosed in polythene bag. Absorbent wadding to collect spillages of blood and cerebrospinal fluid (CSF)

23. HOW TO SEW UP CADAVER
Disposable stapler

24. FIXATIVE FOR STANDARD HISTOLOGY
Formalin followed by disinfection of blocks for histology with 96% formic acid

25. FRESH TISSUE SAMPLES AND DESTINATION
Freeze and store small samples of brain and CSF separately clearly labelled as 'CJD'

26. DISPOSAL OF TISSUES NOT REPLACED IN CADAVER
Incineration

27. FATE OF INSTRUMENTS USED IN DISSECTION
Disposable: disinfection with 2M NaOH followed by incineration
Re-usable: autoclaving, following guidelines in standard publications

28. SPECIAL SURFACE DECONTAMINATION AND CLEANING REQUIREMENTS
2M NaOH for minimum of one hour with repeated wetting of surfaces

29. NEED TO NOTIFY UNDERTAKERS OF RISK OF INFECTION
Yes and return body in body bag

30. NOTIFICATION OF CJD AUTOPSY TO OTHERS
Yes, to the National CJD Surveillance Unit once diagnosis is confirmed

31. SPECIAL PRECAUTIONS FOR PROCESSING TISSUES AFTER ROUTINE FORMALIN FIXATION
Disinfect blocks for histology by immersion in 96% formic acid for one hour prior to processing. Collect formalin used for brain fixation, absorb in sawdust and incinerate. Collect and incinerate wax trimmings. Decontaminate microtome with 2M NaOH after sectioning completed

32. HISTOPATHOLOGY BIOMEDICAL SCIENTISTS WHO MAY PREPARE MICROSCOPY SLIDES
No limitation

33. WHAT TO DO IF EXPOSURE OCCURS
Record names of all staff present in the autopsy suite at time of autopsy and retain records for 40 years

A4 Notification of infectious diseases

A4.1 The notifiable diseases are:

- anthrax
- cholera
- diphtheria
- dysentery (amoebic or bacillary)
- acute encephalitis
- food poisoning
- leprosy
- leptospirosis
- malaria
- measles
- meningitis
- meningococcal septicaemia
- mumps
- ophthalmia neonatorum
- paratyphoid fever
- plague
- acute poliomyelitis
- rabies
- relapsing fever
- rubella
- scarlet fever
- smallpox
- tetanus
- tuberculosis
- typhoid fever
- viral haemorrhagic fever
- viral hepatitis (B,C)
- whooping cough
- yellow fever.

HIV is not on this list, but will be notified by the laboratory making the identification.

A5 Minimum datasets and best practice for examinations and reports on internal organs

The following organ systems should be examined and commented upon. If an organ or system is not examined, this should be noted.

A5.1 Cardiovascular system

- Pericardium including effusion
- Myocardium: atria and ventricles (size, morphology and isolated ventricular weights where indicated)
- Coronary arteries including orifices
- Valves
- Aorta (atheroma)
- Major branches of aorta (particularly in relation to sites of pathology elsewhere)
- Pulmonary arteries and veins (thrombi and emboli)
- Inferior and superior vena cavae, other major and systemic veins

A5.2 Respiratory system

- Mediastinum (including thymus if identifiable)
- Pleural cavity surfaces (visceral and parietal) and effusions
- Lung parenchyma (oedema, consolidation, tumour, infarct, etc.)
- Larynx, trachea and bronchi

A5.3 Gastrointestinal system (including nature of contents of viscera)

- Mouth and tongue
- Salivary glands
- Pharynx
- Oesophagus
- Stomach
- Small and large bowel
- Peritoneum, omentum and mesentery
- Liver
- Gall bladder and bile ducts
- Portal vein
- Pancreas

A5.4 Genitourinary and reproductive system

- Kidneys and renal pelvis
- Ureters
- Bladder
- Urethra (where clinically indicated)
- Male: prostate, testis and penis
- Female: ovaries, uterus and cervix
- Breasts

A5.5 Endocrine system

- Thyroid
- Parathyroids (where clinically indicated)
- Adrenals
- Pituitary

A5.6 Locomotor system

- Bones and joints examined as appropriate to case
  Particularly note fractures and operation sites
- Presence of osteoporosis/infection/arthritis, etc.

A5.7 Reticuloendothelial system

- Spleen
- Lymph nodes – mediastinum, hilar para-aortic, intra-abdominal, cervical, axillary, inguinal
- Bone marrow (vertebral/rib/femur/pelvis, etc.) where clinically indicated
- Thymus if identifiable

A5.8 Central nervous system (CNS)

- Skull
- Cranial cavity
- Dura and dural sinuses
- Meninges
- Circle of Willis
- Cranial nerves
- Brain: external and following sectioning
- Spinal cord (if examined)

A5.9 Routine brain examination

See Section 8.7.6, point 1, in the main document concerning best practice of systematic organ examination. It must be acknowledged that in some cases where there is no pre-mortem clinical indication of CNS disease, examination of the brain may not uncover any significant pathology. It is acceptable practice in consented post-mortems for the brain not to be examined if (a) the pathologist has no reason to believe, on the basis of the clinical information and external examination of the body, that CNS pathology is likely to be present, and (b) it is perceived that brain removal will cause significant distress to the relatives. It is stressed that these cases should be exceptional and that the brain should be examined in all post-mortems authorised by a Coroner or Procurator Fiscal.

Fixation of brain: this will depend of the authorisation for brain removal and retention and on clinicopathological requirements.

A6 Guidelines for autopsy investigation of fetal and perinatal death

All hospital post-mortem procedures are subject to parental consent that must not be exceeded. The following guidelines apply to an unrestricted post-mortem examination.

A6.1 External examination

- Body weight (to nearest gram if less than 5 kg)
- Head circumference
- Crown-heel and crown-rump lengths
- Foot length
- Apparent gestation
- Maceration (if baby is born dead)
- Meconium staining
- Full description to include, e.g. fontanelles, eyes, ears, nose, mouth and palate, digits, palmar creases, umbilicus and state of cord, genitalia, anus, etc.
- Dysmorphic features, congenital malformations and deformities
- Other abnormalities (e.g. oedema, abnormal pallor).

A6.2 Internal examination

- Comment on cranial, thoracic and abdominal cavities
- Retention and fixation of the brain where practicable, subject to informed consent
- Systematic description of major organs and tissues
- Specific reference to ductus arteriosus and umbilical vessels
- Weights of all major organs in a digital balance (to 0.1 g)
- Comment on muscle and skeleton.

A6.3 Placenta

Placenta to be examined in all cases. A convenient method of ensuring that the placenta is available in each case may be to send all placentas from babies admitted to the special care baby unit/neonatal intensive care unit to the pathology department. Whilst these need not be examined unless the baby dies, many departments would, in any case, consider it good practice to examine them.

- Dimensions
- Trimmed weight
- Umbilical cord (length, vessels, abnormalities)
- Membranes (complete, incomplete, colour, abnormalities)
- Fetal, maternal and cut surfaces.

A6.4 Histology

- At least one block of all major thoracic and abdominal organs (right and left lungs, heart, liver, kidney, thymus, adrenals and pancreas)
- Costochondral junction (over 24 weeks' gestation)
- Adequate sampling of brain (varies with case: minimum of one block from hind brain and one from cerebral hemispheres)
- Adequate sampling of placenta (cord, membranes, focal lesions, grossly normal parenchyma to include amnion and decidua).

A6.5 Special procedures and investigations

- X-ray mandatory for suspected skeletal dysplasia and multiple malformations
- Photography mandatory for dysmorphic fetuses and babies without ante-mortem diagnosis; advised for other gross abnormalities
- Bacteriology (blood/spleen/lung/CSF), if clinically indicated
- Virology, if clinically indicated
- Karyotype, if clinically indicated
- Storage of fibroblasts/frozen tissue/DNA, if clinically indicated
- Biochemistry, if clinically indicated
- Haematology, if clinically indicated
- Neuropathology, if clinical or radiological evidence of CNS pathology or the brain appears abnormal on external examination.

A6.6 Autopsy reports

- Demographic details
- Date of autopsy
- Details of consent and any restrictions
- Availability of clinical records at time of post-mortem, including anomaly scans if relevant
- Attendance of clinician
- Clinical history
- Systematic description of external, internal and placental examination and results of X-rays and other ancillary investigations
- Summary of major findings including sex and apparent gestation, estimated timing of death in babies born dead, adequacy of growth and nutrition, presence/absence of congenital abnormalities, major pathological lesions, evidence of chronic stress or disease prior to death, placental examination
- Commentary addressing the clinical questions and significance of pathological findings
- Mode/cause of death
- Record of photographs and any samples retained
- Record of disposal of any tissues or samples
- A provisional report on the macroscopic findings should be issued within 24–48 hours of the autopsy, with the histology and further investigations incorporated into a final report when available
- Timely dispatch to clinicians with particular reference to the timing of postnatal appointments.

A7 Guidelines for autopsy investigation in post-neonatal infant deaths or sudden unexpected deaths in infancy

Most of these examinations will be authorised by HM Coroner or the Procurator Fiscal, with whom all procedures, sampling and retention of tissues must be explicitly agreed. Parental consent is required for any additional procedure or for the use of tissue, blocks and slides for research. Parents should be informed of any tissue or organ retained. They should be offered the opportunity of return, if possible, of any organs retained when the investigation is complete.

The Retained Organs Commission is preparing a consultation document regarding the status of blocks and slides. The College's view is that the return of blocks and slides prevents re-evaluation of a death should further information, of whatever nature, become available, and prevents audit of the quality of services provided to the Coroner: return of this material is not supported.

The following guidelines apply particularly to sudden unexpected deaths in the first year of life.

A7.1 Demographic data and history

- Dates of birth and death; age; date of autopsy; date of report; local code number and identifiers; address
- Name of mother
- Authorisation for post-mortem examination
- Availability of clinical notes
- Availability of event scene investigation and the Coroner's officer's report
- Attendance of clinician, police officers or others
- Method of identification
- Detailed history, to include details of pregnancy and delivery, post natal history, ante-mortem history and precise circumstances of death. Relevant details would include gestational age, birth weight, complications of delivery, feeding, any illnesses or hospital attendances, immunisations, details of siblings, reference to the child protection register, drug use, time last seen alive, time found dead and by whom, where found, co-sleeping, state of body when found (warm, cold, rigor, etc.) and any resuscitation.

A7.2 External examination

- Weight (to nearest gram if under 5 kg)
- Measurement of head circumference, crown–heel and crown–rump lengths
- General state of body: clothing, nutrition, cleanliness
- Rigor mortis
- Hypostatic staining
- Secretions or blood around nose and mouth
- Petechial haemorrhages on face, conjunctivae or oral mucosa
- Any evidence of injury (radiology mandatory if any injury present)
- Full external description to include eyes, ears, scalp, fontanelles, nose, mouth and frenulum of upper lip, digits, umbilicus, anus, genitalia and limbs
- Dysmorphism.

A7.3 Internal examination

- Inspection of cranial, thoracic and abdominal cavities
- Weight of all major organs on digital balance to 0.1 g
- Measurement of thoracic and abdominal fat thickness
- Systematic description of skull, spinal column and cord, ribs and major organs including brain, heart, upper and lower airways, lungs, thymus, spleen, liver, intestines, kidneys, bladder, adrenals, pancreas and gonads, noting whether organs normal or abnormal. Comment on state of ductus arteriosus and umbilicus.

A7.4 Histology

Paraffin sections. Minimum blocks include:

- epiglottis and larynx
- trachea (including thyroid)
- four lobes of lung (H&E plus at least one section also stained by Perls' method)
- heart (posterior left and right ventricle and interventricular septum)
- thymus
- duodenum (including head of pancreas)
- liver (left triangle, right square)
- spleen
- mesentery with lymph node
- adrenal gland
- kidney
- costochondral junction of right 6th rib
- muscle (diaphragm and pectoralis major or psoas)
- blocks of any lesion.

A7.5 Neuropathology

The neonatal brain is extremely soft and requires great care (and sometimes immersion in saline) for atraumatic removal.
4–6 blocks, including cerebral hemisphere, brain stem, cerebellum and meninges, and spinal cord, should be taken for histology.
The pathologist examining these cases must be familiar with the normal morbid anatomy and changes produced by natural disease and by trauma. Where there is neither clinical evidence nor any macroscopic autopsy finding to explain death, it is recommended that the brain be examined only after adequate fixation. Full sampling, to exclude both natural disease and injury, is essential in such cases.

A7.6 Additional investigations that may be indicated

- Photography of any abnormality
- Radiology: a full skeletal survey reported by a paediatric radiologist is mandatory unless the clinical history is well defined and there is no suggestion of injury
- Wherever there is suspicion of intracranial injury, no needle should be placed within the skull or the eye until the scalp, skull and intracranial contents have been examined and injury excluded
- Bacteriology of blood, CSF, respiratory tract and any infective lesion
- Virology (postnasal swabs or nasopharyngeal aspirate, lung. CSF or ileal contents if indicated)

- Sample of skin or pericardium for fibroblast culture (tissue and method as advised by local laboratory) for possible metabolic tests and as a source of DNA
- Biochemistry (vitreous fluid if evidence of e.g. diarrhoea, dehydration or suspicion of salt poisoning. Urine if available saved for metabolic investigations or toxicology)
- Frozen sample of liver and kidney for frozen section for fat (mandatory in all unexplained unexpected infant deaths unless another screening method for disorders of fatty acid oxidation is used).
- Consider saving samples for immunology, toxicology and genetic investigations (e.g. storage of pericardium for tissue culture and spleen for future DNA studies).

The report should include details of any samples kept and instructions for their further retention or disposal. The final report should summarise the main pathological findings and include a commentary addressing any clinical questions or other concerns. Pathologists should assist any multidisciplinary case review and record their attendance.

A8 Neuropathological cases

A8.1 GENERAL

The following is a summary of the main points which should be noted in autopsies involving neurological, neuro-surgical, psychiatric and epilepsy deaths. Further details are given in the British Neuropathological Society's *Guidelines for good practice in neuropathology*. This contains minimum datasets for neuropathological examination in the following areas:

- Alzheimer's disease
- non-Alzheimer dementias
- neuropathological cases with a significant risk of infection
- perinatal neuropathology
- stroke
- CNS trauma.

Pathologists should consider whether cases need referral to Regional Centres of Neuropathology.

Disorders of skeletal muscle and peripheral nerve disorders may require complex histochemistry of snap frozen tissues and electron microscopy.

Surgeons or interventional radiologists should be invited to observe or participate in dissection, where appropriate.

A8.1.1 External examination

CSF should be taken from the cisterna magna before starting in selected cases, e.g. suspected bacterial meningitis.

A8.1.2 Histology of related tissues

Additional organs may include the pituitary, sensory and autonomic ganglia, middle ear and orbital contents.

A8.1.3 Dissection of the neck

The extracranial carotid arteries should be removed *en bloc* from the mastoid process to the level of the upper sternum and examined as multiple transverse sections. Vertebral arteries should be examined *in situ*, or as part of *en bloc* removal of the cervical spine.

A8.1.4 Examination of skull and brain

- Careful examination of scalp for haemorrhage or bruising.
- Care should be taken not to induce fractures during removal of the calvarium. An estimate of its thickness should be made.
- Special techniques may be needed for examination of the posterior fossa or upper spinal cord, e.g. cutting a wedge from the occiput combined with laminectomy.
- Hydrocephalus may require *in situ* examination with removal of the upper vertebral column and sectioning through the facial bones.

Careful reconstruction is essential if a satisfactory cosmetic result is to be obtained.

A8.1.5 Preliminary inspection of the brain

- The brain should not be sliced before fixation. Careful macroscopic examination will often provide information for a preliminary cause of death.
- Fresh samples should be taken for microbiology, virology or neurochemistry as needed. Direct smears or aspiration cytology may assist tumour diagnosis.
- Dissection of the Circle of Willis and arteries prior to fixation is recommended for the identification of aneurysms

- Suspension of the brain in 10% formal saline for 3–4 weeks is essential, with weekly changes of fixative. The spinal cord should be suspended vertically if possible.

A8.1.6 Dissection

- While coronal sectioning of the cerebral hemispheres is traditional, midline sagittal or axial planes may help correlation with CT scan or magnetic resonance images. The brain stem is usually sectioned coronally and the cerebellum sagitally, but both may be sectioned axially.
- Routine blocks should normally include dura, frontal, temporal, parietal, occipital, basal ganglia, thalamic nuclei, hippocampi, mammillary bodies, corpus callosum, cerebral white matter, cerebellum (including dentate nucleus), mid-brain, pons and medulla. In cases in which the pathology is limited to a particular part of the brain, histological sampling may be more restricted.

A8.2 DEATHS IN EPILEPSY

These deaths are almost always performed for a Coroner or Procurator Fiscal.

A8.2.1 Autopsy examination

During the autopsy examination, in addition to a complete macroscopic examination, the following should be documented including an appropriate statement when absent:

- evidence of trauma and asphyxia
- indirect evidence pointing to seizure activity around the time of death, such as tongue bite marks
- full examination of heart and lungs with histology, thereby excluding a primary cardiorespiratory cause for disease
- blood and urine levels of anti-epileptic drugs, ethanol and recreational drugs.

The brain should be examined after fixation, including systematic examination by histology, to establish or exclude any anatomic cause for disease.

A8.2.2 Terms for certification of death in epilepsy

a. 'Sudden unexpected death in epilepsy' (SUDEP)
The death is sudden, unexpected, with or without evidence of seizure. Exclude trauma, drowning, toxicological causes and evident morbid anatomical causes.
The term 'Sudden unexpected death in epilepsy', qualified according to clinical history as 'witnessed' or 'unwitnessed', may be suggested to the Coroner where evidence indicates no other explanation.

b. 'Status epilepticus'
This must be clinically documented. Status epilepticus is a specific clinical entity and cannot be assumed from a post-mortem examination in the absence of good clinical documentation.

c. 'Epilepsy-related deaths'
Epilepsy may be the underlying cause of:
- trauma (head injury)
- drowning
- asphyxia
- aspiration pneumonitis
- airways obstruction from foreign body.

There must be evidence from the clinical history that there was seizure activity at the time of death.

A9 Maternal death

The following sections are collated and amplified from the Department of Health Confidential Enquiries into Maternal Deaths for 1994–1996 and 1997–1999. They summarise the most important pathological aspects of the maternal death autopsy.

Pathologists who perform autopsies on women who are pregnant or who were known to have been pregnant within a year of death should contact the lead clinician to check that the case has been reported. Clinical information for the Enquiries is sometimes incomplete, so pathologists should provide a review of the clinical history in the reports, along with the height and weight of the patient. Fluid balance should be noted and correlated with the pathology.

All cases should have all the major organs sampled for histopathology, including the uterus. The absolute minimum is lungs, heart, kidney, liver, brain, placental site. Specific histological points are noted in relation to the main clinicopathological patterns of maternal mortality.

A9.1 Hypertensive disease

Identify fluid balance. Exclude previous hypertension.
Specific histology: lungs, liver, kidney, heart, brain, placental site.

A9.2 Thromboembolism

Identify predisposing risk factors, previous episodes, family history, anti-coagulant prophylaxis.
Describe the nature and distributions of the emboli, site of origin.

A9.3 Haemorrhage: APH and PPH

Identify the site and severity of bleeding; location of placenta; detail genital tract trauma.
Specific histology: placenta; search for DIC; exclude amniotic fluid embolism.

A9.4 Early pregnancy

Ectopics: ultrasound monitoring and diagnosis. Location and site of ectopic. Estimate blood loss; review the pathology of resected tissues.
Abortions: detail genital tract trauma; site and location of bowel perforation; microbiological culture of tissues and blood.

A9.5 Amniotic fluid embolism

Macroscopic: detailed examination of genital tract for trauma.
Specific histology: both lungs; immunostains for cytokeratin if in doubt.

A9.6 Hyperemesis

Exclude Wernicke's encephalopathy.

A9.7 Epilepsy

Macroscopic: exclude specific brain pathology.
Specific histology: consider eclampsia as cause of fits.
Toxicology: establish anticonvulsant drug levels in the blood.

A9.8 Cardiac deaths

Macroscopic: full description of heart; weigh and measure RV and LV separately.
Specific histology: both ventricles; assess the conducting system; seek specialist opinion if in doubt.

A9.9 Aneurysms

Macroscopic: nature and site of aneurysm.
Specific histology: distribution of arterial pathology.

A9.10 Pre-mortem surgical specimens

The pathologist undertaking a maternal autopsy should also examine or review any recent surgical resection specimen, such as a Caesarian or post-partum hysterectomy. The autopsy report should cross-refer to the surgical specimen, with particular reference to the context of the autopsy findings.

A10 Forensic examinations

A10.1 The practice of forensic pathology is considered to comprise both non-suspicious deaths where a post-mortem examination is requested by HM Coroner and suspicious deaths where a post-mortem examination under the auspices of HM Coroner is performed with a view to providing evidence for a criminal investigation. A department of forensic pathology should have easy access to departments of all other branches of pathology, a department of radiology and a forensic science laboratory. Where possible, all these departments should conform to the code of practice set out by the appropriate medical royal college or other supervising body.

A10.2 Any post-mortem examination carried out by the forensic pathologist should be conducted in accordance with guidelines issued by The Royal College of Pathologists and the Home Office Policy Advisory Board for Forensic Pathology, except where deviations from those guidelines can be justified. It is considered best practice that evisceration of bodies for forensic post-mortem examination is carried out by the pathologist; evisceration may be delegated to the mortuary technician only in 'non-suspicious' deaths where the pathologist is satisfied by personal inspection of the body that that delegation is safe and appropriate and that evisceration is performed in the presence, and under the personal supervision, of that pathologist.

A10.3 The pathologist must ensure that any decision to retain human material at post-mortem examination has been discussed with and ratified by the Coroner; it is the responsibility of the Coroner to make the retention of human material known to the next of kin of the deceased, to determine their wishes about disposal and to make those wishes known to the pathologist; the pathologist must be prepared to justify a decision to retain human material and to explain that decision to the next of kin. The pathologist must have a system of recording what human material has been retained, the authorisation for that retention and the date and method of disposal.

A10.4 It may be that the forensic pathologist will have to perform post-mortem examinations within a mortuary with the 'providers' of which – be they NHS Trust or local authority – he or she has no formal contract of employment. It is not unreasonable, however, for the forensic pathologist to be satisfied that those mortuaries in which he or she may work are equipped to, and have working practices fully observant of, standards set out in the HSAC's *Safe working* document and, if not so satisfied, to make concerns known to the Coroner that such a mortuary is not a suitable place for the practice of post-mortem pathology.

A10.5 The forensic pathologist may bear the responsibility for the safety of other personnel present at a post-mortem examination and, therefore, should conform to the health and safety procedures extant in the mortuary where that examination proceeds: where no such policy is in existence, the forensic pathologist should insist upon demonstration of the adequacy of the facilities for safe post-mortem examination and, if not assured of their presence, should refuse to conduct the examination at that mortuary.

A10.6 Easy access to relevant literature – be it printed or electronic – is no less essential to the forensic pathologist than it is to any other branch of pathology: the head of a department of forensic pathology should ensure that that access is provided and that, where appropriate, that literature is consulted to substantiate opinions expressed.

A10.7 It is accepted that the forensic pathologist may act as 'agent' for HM Coroner and may be under 'contract' with a police force, but the forensic pathologist must not act in any way that is not in accordance with the GMC's *Good Medical Practice* nor in any way which may be regarded as a failure to acknowledge that the pathologist's primary duty is to the court, rather than to any party to court proceedings. It is expected that a department shall have in

place a mechanism by which difficulties encountered in their relationships with mortuaries, Coroners and police forces with whom they may work can be addressed and resolved.

A10.8 The responsibilities of the forensic pathologist in regard to clinical governance, quality assurance and research are no different in kind from those of the histopathologist. The forensic pathologist may be better placed to provide training in post-mortem practice to all those persons who may be concerned with such practice, be they pathologists in training, mortuary assistants or scene-of-crime officers, and a department must be willing to provide such training. Where the forensic pathologist provides such training for trainee pathologists and mortuary technicians, there should be a formal 'record of training' documenting what training has been given and when a satisfactory level of proficiency has been attained.

A11 Sickle cell disease

Guidelines for performing sickle and sickle-trait autopsies

A11.1 The autopsy should be performed as soon after death as possible – sickle cells unsickle sometimes after death and good morphology is lost.

A11.2 All the clinical data, including recent microbiology, and radiology must be gathered.

A11.3 Samples of blood and lung should be taken for microbiological culture.

A11.4 Blood and urine samples for toxicology are required if painkiller overdose (e.g. pethidine) is suspected.

A11.5 The heart must be examined carefully for the full range of causes of sudden cardiac death.

A11.6 Evidence of the acute chest syndrome, gross and histological, must be sought.

A11.7 Histology from all relevant organs must be taken, particularly the lungs, bones and marrow, muscle, kidney and heart.

A11.8 Fix tissues in buffered formalin, to reduce post-mortem intravascular sickling.

A11.9 Distinguish between post-mortem sickling (HbSS and HbAS cells can do this) and pre-mortem sickling.

A11.10 The clinical pathology should be discussed with the clinicians; if the case is Coronial, it should be emphasised to the Coroner the importance of seeking detailed statements from the clinicians to determine, as best as possible, the sequence of events that led to death.

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