

Guidelines on Minimising the Risk of Transmission of Transmissible Spongiform Encephalopathies in Healthcare Settings in Ireland

CJD Infection Control Committee

on behalf of:

**Scientific Advisory Committee, National Disease Surveillance
Centre**

and,

**National CJD Advisory Committee, Department of Health and
Children**

Table of Contents

INTRODUCTION AND SUMMARY OF RECOMMENDATIONS	3
CHAPTER 1: THE TRANSMISSIBLE SPONGIFORM ENCEPHALOPATHIES	6
CHAPTER 2: RISK ASSESSMENT FOR VCJD IN IRELAND AND IATROGENIC TRANSMISSION OF TSE'S	8
CHAPTER 3: PRECAUTIONS FOR SURGICAL PROCEDURES	16
CHAPTER 4: DECONTAMINATION OF MEDICAL DEVICES	21
CHAPTER 5: INSTRUMENT QUARANTINE	26
CHAPTER 6: INSTRUMENT TRACKING	29
CHAPTER 7: MANAGEMENT OF CLINICAL PROCEDURES AND ADMINISTRATIVE ISSUES	32
CHAPTER 8: AUDIT OF DECONTAMINATION PROCEDURES	37
APPENDIX A: DIAGNOSTIC CRITERIA FOR TSES	39
APPENDIX B: DENTAL PROCEDURES	42
APPENDIX C: ENDOSCOPY	43
APPENDIX D: ROUTINE PATIENT CARE	46
APPENDIX E: LABORATORY SAFETY	50
APPENDIX F: AFTER DEATH	53
APPENDIX G: MANAGEMENT OF POSSIBLE EXPOSURE TO TSES VIA MEDICAL DEVICES	56
APPENDIX H: MEMBERSHIP OF CJD INFECTION CONTROL SUBCOMMITTEE	59
REFERENCES	60
GLOSSARY	63

Introduction and Summary of Recommendations

The National CJD Advisory Committee of the Department of Health and Children (DOHC) requested the Scientific Advisory Committee of the National Disease Surveillance Centre (NDSC) to form a subcommittee to advise on prevention of iatrogenic transmission of Creutzfeldt-Jakob Disease (CJD) and other transmissible spongiform encephalopathies (TSEs). The terms of reference of this subcommittee were to update current Irish infection control guidelines in relation to minimising the risk of transmission of spongiform encephalopathies in the health care setting. The principal focus of the subcommittee was to examine potential transmission of TSEs via contaminated medical devices, along with general infection control guidelines for preventing iatrogenic transmission of TSEs in healthcare settings.

Draft guidelines, broadly in line with World Health Organisation (WHO) recommendations, were released in July 2002. In December 2003 the UK Spongiform Encephalopathy Advisory Committee (SEAC) released updated guidelines on preventing the transmission of TSEs. The updated UK guidelines took account of recent evidence relating to inactivation of prion infectivity and differed significantly from previous UK guidelines. The Irish guidelines have thus been updated to also take account of recent evidence and are now broadly in line with UK recommendations.

The subcommittee wishes to acknowledge the assistance of Prof D Jeffries, former chair of the UK SEAC, in formulating aspects of these guidelines.

The following summarises the key recommendations within this document: details of the recommendations can be found in the relevant chapters. Additional recommendations, relating to dental procedures, routine patient care, laboratory safety, after death and management of possible iatrogenic exposures to TSEs are contained in the appendices. The evidence base relating to human TSEs is continually evolving and these guidelines may need to be updated in the future, to take account of new evidence.

General principles

- Critical devices that have been contaminated with altered prion protein and cannot be effectively decontaminated must be destroyed by incineration.
- Patients who undergo procedures where there may be contact with tissues considered high risk (brain, spinal cord, posterior eye) or medium risk (anterior eye, olfactory epithelium) infectivity for a TSE other than vCJD must have a preoperative assessment to determine if they are in an at-risk category for developing a TSE (section 2.5).
- Patients who have been informed that they are at risk of developing an iatrogenic TSE, including vCJD, should alert healthcare staff to this potential risk prior to any invasive procedure (section 2.5).

Precautions for surgical procedures (chapter 3)

- For surgical procedures on patients with a known or suspected TSE, other than variant CJD, and patients in an at-risk group for developing a TSE:
 - Where the diagnosis is confirmed or cannot be excluded instruments that contact high or medium risk tissues must be destroyed by incineration
 - Where the diagnosis is excluded, or where instruments only contact low risk tissues, instruments can be reprocessed using standard methods and returned to use
- For surgical procedures on patients with known or suspected variant CJD, and patients identified as at risk due to iatrogenic exposure (following appropriate epidemiological investigation and risk assessment):
 - Where the diagnosis is confirmed or cannot be excluded instruments that contact high or medium risk tissues must be destroyed by incineration
 - Where the diagnosis is excluded, or where instruments only contact low risk tissues, instruments can be reprocessed using standard methods and returned to use
- For TSEs other than variant CJD high-risk tissues comprise the central nervous system and posterior eye. Medium risk tissues comprise the anterior eye and olfactory epithelium.
- For variant CJD high-risk tissues comprise the central nervous system and posterior eye. Medium risk tissues comprise the anterior eye, olfactory epithelium and lymphoid tissues.
- Gastrointestinal endoscopes used on patients with vCJD need to be destroyed or reserved for use on future patients with vCJD. Endoscopy on patients with other forms of TSE does not pose a transmission risk and endoscopes can safely be reprocessed.

Decontamination of medical devices (chapter 4)

- Thorough physical cleaning, prior to thermal or chemical disinfection, is crucial for effective decontamination of medical devices. Automated washing methods are preferred, wherever possible.
- Previously recommended “TSE-inactivating procedures” are now thought to be counter-productive and may even render prions more resistant to further inactivation. Standard decontamination protocols should be used for most surgical procedures.

Instrument quarantine (chapter 5)

- Reusable instruments potentially contaminated with altered prion protein may need to be quarantined, pending a definitive diagnosis. Instruments should be physically cleaned prior to quarantine.

Instrument tracking (chapter 6)

- All institutions carrying out reprocessing of medical devices must have some form of instrument tracking in place, at least to instrument set level. Institutions carrying out procedures where there is likely to be contact with high TSE-infectivity tissues should consider systems that allow tracking of individual instruments.

Management of clinical procedures and administrative issues (chapter 7)

- Institutions should have dedicated instrument sets for use during procedures where there may be contact with high or medium risk tissues.
- Relevant personnel should be informed if a patient with a known or suspected TSE is admitted to a healthcare institution, particularly if any invasive procedures are planned.
- Institutions likely to carry out procedures on patients with a known or suspected TSE should have a written protocol for pre, intra and post-operative management of such procedures.
- Institutions should follow indicators of good practice in relation to decontamination of medical devices, including compliance with relevant European medical device Directives.

Audit of decontamination procedures (chapter 8)

- A national audit of decontamination of medical devices is required.

Chapter 1: The Transmissible Spongiform Encephalopathies

Transmissible spongiform encephalopathies (TSEs) are fatal degenerative brain diseases that occur in humans and some animal species. The causative agent is a protease-resistant protein, which is an altered form of naturally occurring prion protein (PrP). PrP is normally present in human and animal brain tissue. In TSEs an altered form (also known as the scrapie agent or PrP^{Sc}) accumulates in the brain to produce the characteristic features of TSEs. These altered prion proteins are remarkably resistant to inactivation by standard chemical, thermal and other means of inactivating microorganisms.

The best-known human TSE is Creutzfeldt-Jakob disease (CJD). The disease has a worldwide distribution and incidence of 0.5 to 1.0 cases per million population per year. Most cases of CJD are sporadic and the incidence is thought to reflect the rate of spontaneous mutation of naturally occurring prion protein to the altered form [1,2].

Person to person transmission of TSEs through direct contact does not occur. Iatrogenic transmission is rare and has only occurred through contaminated tissue grafts, use of human pituitary-derived hormones and, in a handful of cases, through contaminated medical devices. Despite the rarity of iatrogenic transmission, the fact that prion proteins are so resistant to inactivation and that TSEs are invariably fatal, has prompted stringent precautions to be routinely taken to prevent iatrogenic transmission. It is perhaps as a result of the introduction of such precautions that no transmission of a TSE via contaminated medical devices has been documented since 1976.

In 1995 a new form of TSE was described in the UK and was labelled variant CJD (vCJD). Patients with vCJD tend to be younger than those with sporadic CJD and have a longer duration of illness, frequently associated with sensory disturbances and psychiatric manifestations. A link has been established between vCJD and bovine spongiform encephalopathy (BSE) in cattle and vCJD appears to have arisen through the consumption of BSE-infected animal products. The altered prion protein in vCJD appears to be more widely distributed in the body, compared to sporadic CJD, particularly in the lymphoreticular system.

The various human forms of TSE are summarised in table 1:

Table 1.1: Human TSEs

Disease	Route of acquisition	Incidence/distribution	Comments
Kuru	Oral, via ritual cannibalism	Only seen in highlands of Papua New Guinea: >2,500 cases reported since 1957	Ritual cannibalism stopped in 1958
Sporadic Creutzfeldt-Jakob disease (CJD)	Most likely due to spontaneous mutation of prion protein	0.5-1 per million population worldwide	Commonest human TSE
Familial CJD	Inheritance of mutation in gene encoding prion protein (PrP)	10-15% of CJD cases	Autosomal dominant inheritance. ~100 families identified worldwide.
Iatrogenic CJD	Transmission of altered prion protein via a medical procedure	Rare. Most cases related to dura mater grafts or human pituitary-derived hormone use. Only 7 cases (2 definite) associated with contaminated medical equipment.	All of the cases associated with contaminated medical equipment occurred prior to 1980.
Gerstmann-Straussler-Scheinker syndrome (GSS)	Inheritance of mutation in PrP gene	About 50 families identified worldwide	Autosomal dominant inheritance.
Fatal familial insomnia (FFI)	Inheritance of mutation in PrP gene	Very rare. Nine families identified worldwide	Autosomal dominant inheritance.
Variant CJD (vCJD)	Probably ingestion of BSE-contaminated animal products	Over 100 cases to date in the UK. One case in Ireland, probably UK-acquired	Wider distribution of altered PrP in human tissues compared to CJD

Chapter 2: Risk Assessment for vCJD in Ireland and Iatrogenic Transmission of TSEs

2.1: Population risk of vCJD in Ireland

A recent study estimated that the total number of vCJD cases in the UK would be between 250 and 4000 [3]. The most recent analysis of data, up to the end of 2002, has shown that the epidemic in the UK has almost certainly peaked and the upper limit for predicted future cases in the UK has been reduced to no greater than 540 cases [4].

The risk of past exposure to BSE-infected meat products in Ireland appears to be lower than that in the UK. Based on surveillance data for cattle older than two years the annual incidence of BSE in Irish cattle was 0.1% to 1.1% that of cattle in the UK up to 1996 (data courtesy of Department of Agriculture, Food and Rural Development (DAFRD)). The total number of future clinical and non-clinical cases of BSE in Irish cattle has been estimated at 489 cases. Even with this projected number of future BSE cases the population risk of vCJD in Ireland should still be considerably smaller than that of the UK.

There are a number of stringent controls in place to ensure that BSE-infected animal products cannot enter the food chain in Ireland. Since 1990 any clinical case of BSE is removed from the food chain with compulsory notification. Mechanically recovered meat was banned in Ireland in 1996. All specified risk material is removed in abattoirs, stained and kept separated from other animal products to ensure that it does not enter the human or animal food chains. Meat and bone meal is excluded from the animal food chain. All cattle are examined prior to slaughter and any clinically suspect cases are removed from the food and feed chain. All cattle aged over 30 months are screened for BSE using an approved test.

A recent rigorous analysis of the risk of vCJD in Ireland estimated one future case of vCJD in Ireland (95%CI 0-15). The risk of vCJD in Ireland may come from BSE-infected indigenous beef products, imported UK beef products or residence in the UK between 1980 and 1996. This study concluded that the relative proportion of vCJD risk in Ireland attributable to these three sources is 2:2:1 respectively [5]

2.2: Infectivity of tissues with TSEs

The risk of transmission of TSEs via surgical instruments is related to four factors:

1. The infectivity of the tissues in patients with TSEs that the instrument comes in contact with
2. The amount of residual infectivity remaining on the instrument following decontamination
3. Which tissues the instrument comes in contact with during subsequent use in other patients
4. The susceptibility of subsequent patients to TSEs

It is assumed that the risk of becoming infected through exposure to prion agents is directly proportional to the dose of prion agent received and, by extension, to the residual infectivity in the case of surgical instruments used on tissues containing prion agents [6].

The levels of tissue infectivity for vCJD and other TSEs are summarised in table 2.1, which has been adapted from the 2003 updated UK guidelines (“Infection control of CJD and related disorders in the healthcare setting” www.dh.gov.uk)

Prion agent has been detected in the optic nerve and retina of a patient with vCJD at levels equivalent to 2.5% and 25% respectively of the levels found in the brain. The prion agent was not detected in the sclera, vitreous humour, lens, aqueous humour, iris or cornea [12]. The levels of infectivity in ocular tissues for sporadic CJD appears to be similar to the levels found in vCJD [11]. Animal studies, using a scrapie model of infection, found infectivity levels in the optic nerve and retina comparable with levels in the brain [13]. Overall, the infectivity levels in the retina and optic nerve for all TSEs are likely to be similar to those of brain and spinal cord while the levels in other parts of the eye are likely to be 10 to 100 times lower.

The absence of detectable PrP^{Sc} does not necessarily mean absence of infectivity. Conversely, detection of small amounts of PrP^{Sc} in a tissue does not necessarily mean that it would transmit disease in all circumstances. In general terms, there is thought to be a broad correlation between PrP^{Sc} load in a given tissue and the likelihood that the given tissue might present a risk of infection. The relative levels of PrP^{Sc} in different tissues provide useful information for the assessment of relative risks of different procedures.

Table 2.1: Summary of TSE tissue infectivity

Tissue	Presence of abnormal Prion Protein and level of infectivity			
	CJD other than vCJD		vCJD	
	PrP ^{Sc} detected	Assumed level of infectivity	PrP ^{Sc} detected	Assumed level of infectivity
Brain	Yes	High P	Yes	High P
Spinal cord	Yes	High P	Yes	High
Spinal ganglia	Yes	High	Yes	High
<i>Dura mater</i>	Not tested	High	Not tested	High
Cranial nerves	Yes	High	Yes	High
Cranial ganglia	Yes	High	Yes	High
Posterior eye	Yes	High P	Yes	High
Anterior eye and cornea	No	Medium	No	Medium
Olfactory epithelium	Yes	Medium	Not tested	Medium
Tonsil	No	Low	Yes	Medium P
Appendix	No	Low	Yes ¹	Medium ¹
Spleen and thymus	No	Low P ²	Yes	Medium P
Other lymphoid tissues	No	Low P ²	Not tested	Medium P
Peripheral nerve	No	Low	No	Low
Dental pulp	No	Low	Not tested	Low
Gingival tissue	Not tested	Low	Not tested	Low
Blood and bone marrow	Not tested	Low	Not tested	Low
CSF	No**	Low P ³	No	Low
Placenta	Not tested	Low	No	Low
Urine	Not tested	Low	Not tested	Low
Other tissues	Not tested	Low P ²	Not tested	Low

P = infectivity proven in experimental transmission studies

¹Prion agent has been detected in the appendix in vCJD cases and in one of 8,000 random UK appendix samples but the level of infectivity appears to be considerably lower than that found in tonsils from vCJD cases

²See reference [11] (Brown *et al* 1994) for results of experimental transmission in CJD (other than variant CJD)

³Although PrP^{Sc} has not been detected in the CSF in either sporadic or variant CJD, experimental transmission of infectivity has been achieved from CSF in sporadic CJD in 4 of 27 primates by intracerebral inoculation indicating that levels of infectivity are likely to be much lower than in the central nervous system (CNS)[11].

The potential for transmission of prion agent via medical devices depends not only on the level of infectivity in the source tissue but also on the type of tissue subsequently contacted. For most surgical procedures dedicated instruments are unlikely to be used for procedures where other types of tissue will be contacted (e.g. neurosurgical instruments are unlikely to be used for procedures on the lymphoreticular system). The use of dedicated instrument sets for high/moderate risk procedures combined with instrument tracking systems, as detailed later in this document, should eliminate the risk of instruments being reused for different types of procedures. Infectivity estimates have been produced for vCJD, based on instruments being reused for similar

types of procedure, by the CJD Incidents Panel in the UK [7]. These are summarised in table 2.2.

Table 2.2: Potential infectivity of variant CJD, by source tissue and site of exposure

Source tissues and tissues exposed during surgery	Disease stage	Infectivity (ID ₅₀ /g)
CNS, retina or optic nerve to CNS, retina or optic nerve	First ~60% of incubation period	0-10 ⁴
	Last ~40% of incubation period and during clinical disease	10 ⁸ -10 ¹⁰
Other parts of the eye to other parts of the eye	First ~60% of incubation period	0-10 ⁴
	Last ~40% of incubation period and during clinical disease	10 ⁵ -10 ⁶
Lymphoreticular system to lymphoreticular system	All of the incubation period and during clinical illness	10 ⁵ -10 ⁶
Remaining tissues, including blood	All of the incubation period and during clinical illness	0-10 ⁴

ID₅₀= infectious dose likely to cause disease in 50% of recipients

The levels of infectivity of all TSEs are highest in the brain and spinal cord, and are generally a number of orders of magnitude higher than in other tissues [8-11].

The altered prion protein responsible for vCJD has been found in tonsil, spleen appendix and thymus and may be present in other lymphoid tissue. The highest concentration outside of the CNS appears to be in the tonsils. Wadsworth et al found that the concentration of prion protein found in tonsillar tissue is approximately 10% that of brain tissue [12]. More recent data has shown that the level of infectivity in tonsils and spleen is similar and is 100 to 1000 times lower than infectivity levels in brain [8]. It is not known what the concentration of prion protein in tonsillar tissue is during the incubation period of vCJD but it is unlikely to be higher than that seen in advanced cases.

A number of studies have reported evidence of prion agent in the appendix of patients with vCJD, though the level of infectivity appears to be lower than that of other lymphoid tissue [12,14,15]. A recent study of UK tissue samples found accumulation of prion protein in three out of 12,674 appendectomy specimens [16].

For sporadic CJD most studies have not found significant levels of infectivity outside of the CNS, including lymphoid tissues. PrP^{Sc} was detected in the rectum, adrenal gland and thymus of one patient with sporadic CJD, though the levels were only 1/50,000 those of brain tissue [12].

2.3: Impact of decontamination procedures

Surgical instruments may be contaminated with an average of 5-10mg of organic material directly after surgery [6]. Thorough physical cleaning should remove most of

this material and is vital to the overall decontamination of instruments. For routine situations a single physical cleaning should reduce infectivity by at least a factor of 10^2 - 10^3 [6].

The UK CJD Incidents Panel uses the assumption that a single physical cleaning cycle combined with autoclaving should reduce infectivity levels by a factor of at least 10^5 [7]. However, this is a cautious estimate that allows for less than optimal working practices. In ideal settings thorough physical cleaning followed by an effective sterilisation procedure, should reduce the level of residual TSE infectivity on surgical instruments by a factor of at least 10^7 [17,18]. This greatly exceeds the minimum reduction in titre of 10^4 , considered by some authors as an indication of appropriate disinfection for CJD [18]. This reduction in infectivity is sufficient to eliminate the risk of transmission of TSEs in the majority of surgical procedures. In procedures where there is contact with high infectivity tissues in cases of known or suspected TSE, instruments may be contaminated with levels of prion protein that exceed the limits of decontamination procedures. In such cases instruments cannot be effectively decontaminated after use and, if a TSE is confirmed, must either be destroyed or quarantined for use only on future patients with a confirmed TSE.

The majority of prion infectivity is destroyed by brief exposure to temperatures of 100-121°C, though a small proportion of prion infectivity is highly resistant to heat and other methods of sterilisation [18]. The standard recommendation for decontamination of TSE-contaminated instruments is steam sterilisation at 121-132°C for 60 minutes (gravity displacement autoclave) or 134°C for >18 minutes (pre-vacuum autoclave). Such “TSE-inactivating” procedures have previously been shown to produce a 10^5 or greater reduction in prion infectivity [18]. However recent evidence has shown that thermostable TSE strains, including scrapie and BSE, are not inactivated by exposure to 137°C and that infectivity can remain regardless of the number of times the process is repeated [19]. Given that the standard protocol for autoclaving is currently 135°C for 3-5 minutes the UK Advisory Committee on Dangerous Pathogens now consider it unnecessary to increase the autoclave temperature or lengthen the holding time. Furthermore lengthening the holding time may render prions more resistant to further inactivation [19].

2.4: Persons at increased risk of developing TSE

2.4.1: Iatrogenic transmission of CJD

Iatrogenic transmission of CJD has been associated with:

- Dura mater grafts (~110 cases worldwide)
- Human cadaver pituitary-derived hormone (~130 cases worldwide)
- Contaminated medical equipment (~7 cases worldwide)

There have been three cases of CJD associated with corneal transplantation (one definite, one probable, one possible). A detailed risk assessment is currently underway in the UK to determine if receipt of a corneal graft should be considered a risk factor for development of CJD.

One iatrogenic case of CJD was reported in Ireland in 2001, which was linked to prior human pituitary-derived growth hormone use.

Of the 16 countries that have documented dura mater-associated cases, 67 occurred in Japan with a median of 2 (range 1-8) cases in each of the remaining 15 countries [20]. In addition the vast majority of implicated grafts have been the product of a single commercial producer, where decontamination of the grafts with NaOH during commercial preparation was not carried out [19,20]. The implicated commercial product (“Lyodura”, manufactured by B Braun Melsungen AG) was one of a number of products licensed for use in Ireland. It was officially withdrawn from the Irish market in 1987 (Irish Medicines Board, personal communication). It is still possible that stored Lyodura may have been used in a small number of neurosurgical procedures in Ireland up to 1993. Dura grafts are no longer used in Ireland and no licensed products are available.

More than half of all human pituitary-derived growth hormone-related CJD cases have occurred in France, with smaller numbers of cases in the United Kingdom, United States and New Zealand. All of the cases reported to date appear to be related to growth hormone therapy prior to 1985. Likewise the risk of CJD transmission appears to have been lowest with commercially prepared hormone [20]. Human pituitary-derived growth hormone was used in Ireland up to 1985, when it was discontinued. All of the product used in Ireland was imported and was produced by commercial companies (Irish Medicines Board, personal communication).

There have only been two confirmed cases of transmission of CJD via contaminated medical equipment. These were both related to the use of stereotactic electrodes that were implanted in a patient with known CJD. The electrodes were cleaned with benzene, followed by 70% alcohol and formaldehyde vapour prior to being reused on other patients, a procedure now known to be inadequate for inactivating prion protein [21]. Retrospective studies suggest that five other cases of CJD may have been associated with reuse of contaminated neurosurgical instruments [20]. No CJD cases associated with contaminated medical equipment have been reported since 1976.

Two cases of vCJD have been reported in the UK that may have been related to blood transfusion. In both cases the patients had previously received a blood transfusion where the donors had subsequently been diagnosed with vCJD. If vCJD can be transmitted by blood this does not alter the recommendations for handling of surgical instruments, as the level of prion infectivity in blood is likely to be very low and readily eliminated with appropriate physical cleaning and decontamination procedures. Patients who have received blood or blood products may, however, be categorised as “at risk” for public health purposes, as detailed in section 3.3 of table 2.3.

2.4.2: Familial TSEs

Approximately 5-10% of TSEs are hereditary. These hereditary forms include familial CJD (about 100 extended families identified worldwide), fatal familial insomnia (nine families) and Gerstmann-Straussler-Scheinker syndrome (about 50 families identified). All demonstrate autosomal-dominant transmission. There is no evidence of genetic or vertical transmission of vCJD. A familial TSE has been described in two

generations of one family of Irish decent [22]. A single case of fatal familial insomnia was reported in Ireland in 1997, though no other cases have been identified in the same family to date (Irish National CJD Surveillance Unit, personal communication).

It seems prudent to consider persons who have a documented family history of a familial TSE as being at higher risk of developing a TSE, compared to the general population, as detailed in table 2.3.

2.5: Patient risk groups

When considering measures to prevent transmission to patients or staff in the healthcare setting, it is useful to make a distinction between *symptomatic* patients, *i.e.* those who fulfil the diagnostic criteria for definite, probable or possible CJD or vCJD, and *asymptomatic* patients *i.e.* those with no clinical symptoms, but who are potentially *at risk* of developing one of these diseases, *i.e.* having a medical or family history which places them in one of the risk groups – see Appendix A for diagnostic criteria. Table 2.3 below details the classification of the risk status of symptomatic and asymptomatic patients.

Table 2.3: Categorisation of patients by descending order of risk

1: Symptomatic patients	<p>1.1: Patients who fulfil the diagnostic criteria for definite, probable or possible CJD or vCJD (see Appendix A for diagnostic criteria).</p> <p>1.2: Patients with neurological disease of unknown aetiology who do not fit the criteria for possible CJD or vCJD, but where the diagnosis of CJD is being actively considered</p>
2: Asymptomatic patients at risk from familial forms of CJD linked to genetic mutations	<p>2.1: Individuals who have or have had two or more blood relatives affected by CJD or other prion disease, or a relative known to have a genetic mutation indicative of familial CJD.</p> <p>2.2: Individuals who have been shown by specific genetic testing to be at significant risk of developing CJD or other prion disease.</p>
3: Asymptomatic patients potentially at risk from iatrogenic exposure*	<p>3.1: Recipients of hormone derived from human pituitary glands, <i>e.g.</i> growth hormone, gonadotrophin.</p> <p>3.2: Individuals who have received a graft of <i>dura mater</i>. (People who underwent neurosurgical procedures or operations for a tumour or cyst of the spine prior to 1994 may have received a graft of <i>dura mater</i>, and should be treated</p>

as *at risk*, unless evidence can be provided that *dura mater* was not used).

3.3: Patients who have been exposed to instruments used on, or in receipt of blood, plasma derivatives, organs or tissues donated by, a patient who went on to develop CJD or vCJD (Note: such exposures can only be classified as an exposure risk following appropriate look-back investigations and risk assessment)

*A decision on the inclusion of corneal graft recipients in the “iatrogenic *at risk*” category is pending completion of a UK risk assessment.

Chapter 3: Precautions for Surgical Procedures

The division of clinical procedures into risk categories for iatrogenic transmission of TSE's is dependant on three factors:

1. The possible presence and concentration of altered prion protein in the tissues contacted during the procedure (i.e. tissue infectivity)
2. Whether or not the patient falls into one of the recognised risk categories, as outlined at 2.5 (i.e. status of patient)
3. The type of TSE (i.e. CJD vs. vCJD)

Recommended precautions for dental procedures are given in Appendix B.

Recommended precautions for endoscopy are given in Appendix C.

3.1: Procedures on high-infectivity and medium-infectivity tissues

High-infectivity tissues are brain, spinal cord and posterior eye. Medium-infectivity tissues, for all forms of TSE, are anterior eye and olfactory epithelium. In addition lymphoid tissue is considered a medium-risk tissue for vCJD.

3.1.1: Invasive procedures on high-infectivity and medium-infectivity tissues in definite or probable cases of TSE

All efforts should be made to avoid such procedures on patients with a known TSE. If such procedures are unavoidable, instruments that contact such tissues must be disposed of by incineration after use and cannot be reprocessed.

3.1.2: Procedures on high-infectivity and medium-infectivity tissues in possible cases of TSE

The most common scenario where this may arise is brain biopsies for suspected cases of TSE (see diagnostic criteria in Appendix A). Adequate single-use instruments are not available for brain biopsy.

Instruments used for brain biopsies on suspected cases of TSE may be contaminated with high levels of altered prion protein. These instruments should be quarantined, pending the biopsy result, as detailed in chapter 5.

If the biopsy confirms the presence of a TSE, or the diagnosis is inconclusive, the instruments, along with the quarantine container, should be destroyed by incineration.

If the biopsy is negative for TSE and an alternative diagnosis is confirmed the instruments should be reprocessed, as detailed in chapter 4.

3.1.3: Procedures on high-infectivity and medium-infectivity tissues in asymptomatic patients considered to be at risk of developing a TSE

If an asymptomatic patient has a recognised risk for developing a TSE, as outlined in sections 2 and 3 of table 2.3, instruments that contact such tissues must be destroyed by incineration.

3.2: Procedures on low-infectivity tissues

All other tissues, i.e. other than high-infectivity and medium-infectivity tissues, are considered to be low-infectivity tissues. Reusable instruments that contact such tissues can be reprocessed using the methods outlined in chapter 4, regardless of the patient's symptoms or risk category and regardless of the type of TSE (i.e. CJD and vCJD).

3.3: Summary of recommendations for handling surgical instruments

The following tables and flow charts summarise the recommendations for handling of surgical instruments, relating to CJD and vCJD.

Table 3.1: Precautions for handling surgical instruments relating to TSEs other than vCJD

Tissue Infectivity	Status of patient			
	Definite/probable	Possible	Asymptomatic Genetic risk	Asymptomatic Iatrogenic risk
High: • Brain • Spinal cord • Posterior eye	Destroy by incineration	Quarantine pending final diagnosis	Destroy by incineration	Destroy by incineration
Medium: • Anterior eye* • Olfactory epithelium	Destroy by incineration	Quarantine pending final diagnosis	Destroy by incineration	Destroy by incineration
Low/none detectable	Routine reprocessing	Routine reprocessing	Routine reprocessing	Routine reprocessing

Table 3.2: Precautions for handling surgical instruments relating to vCJD

Tissue Infectivity	Status of patient			
	Definite/probable	Possible	Asymptomatic Genetic risk	Iatrogenic risk*
High: • Brain • Spinal cord • Posterior eye	Destroy by incineration	Quarantine pending final diagnosis	Not applicable	Destroy by incineration
Medium: • Lymphoid tissue • Anterior eye* • Olfactory epithelium	Destroy by incineration	Quarantine pending final diagnosis	Not applicable	Destroy by incineration
Low/none detectable	Routine reprocessing	Routine reprocessing	Not applicable	Routine reprocessing

*In general, it is not possible to identify specific risk groups for the iatrogenic transmission of vCJD. However, individual patients who have been potentially exposed to vCJD (for example *via* surgical instruments used on a patient who went onto develop vCJD, or blood products derived from a donor who went on to develop vCJD) may be identified as at risk, following an appropriate epidemiological investigation and risk assessment. In these circumstances the individuals will have been informed of the risk, as detailed in Appendix G, and advised to inform clinicians in the event of them needing surgery.

Figure 3.1 : Flow chart for precautions for surgical procedures on known, suspect or at risk patients: TSEs other than variant CJD

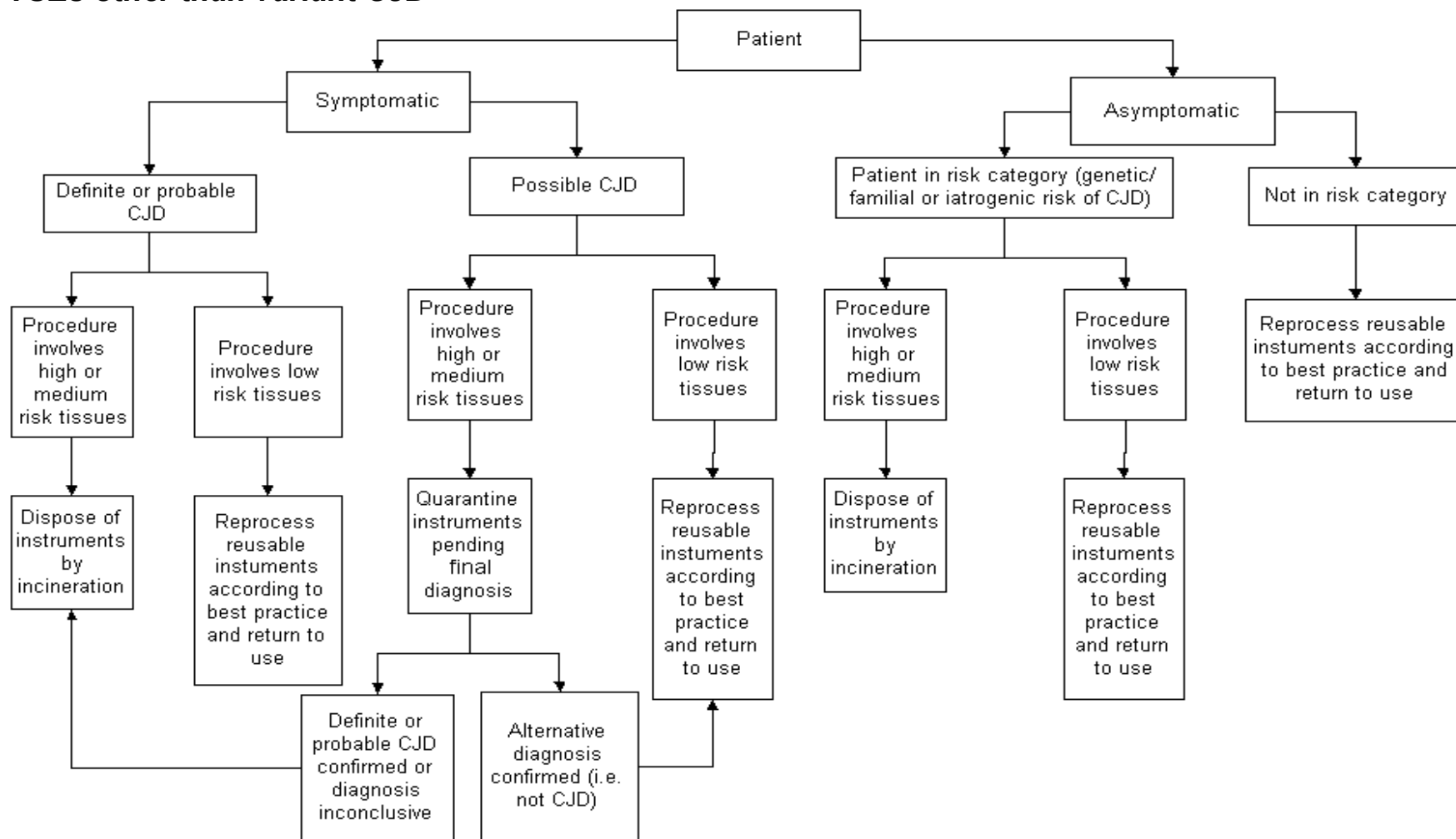
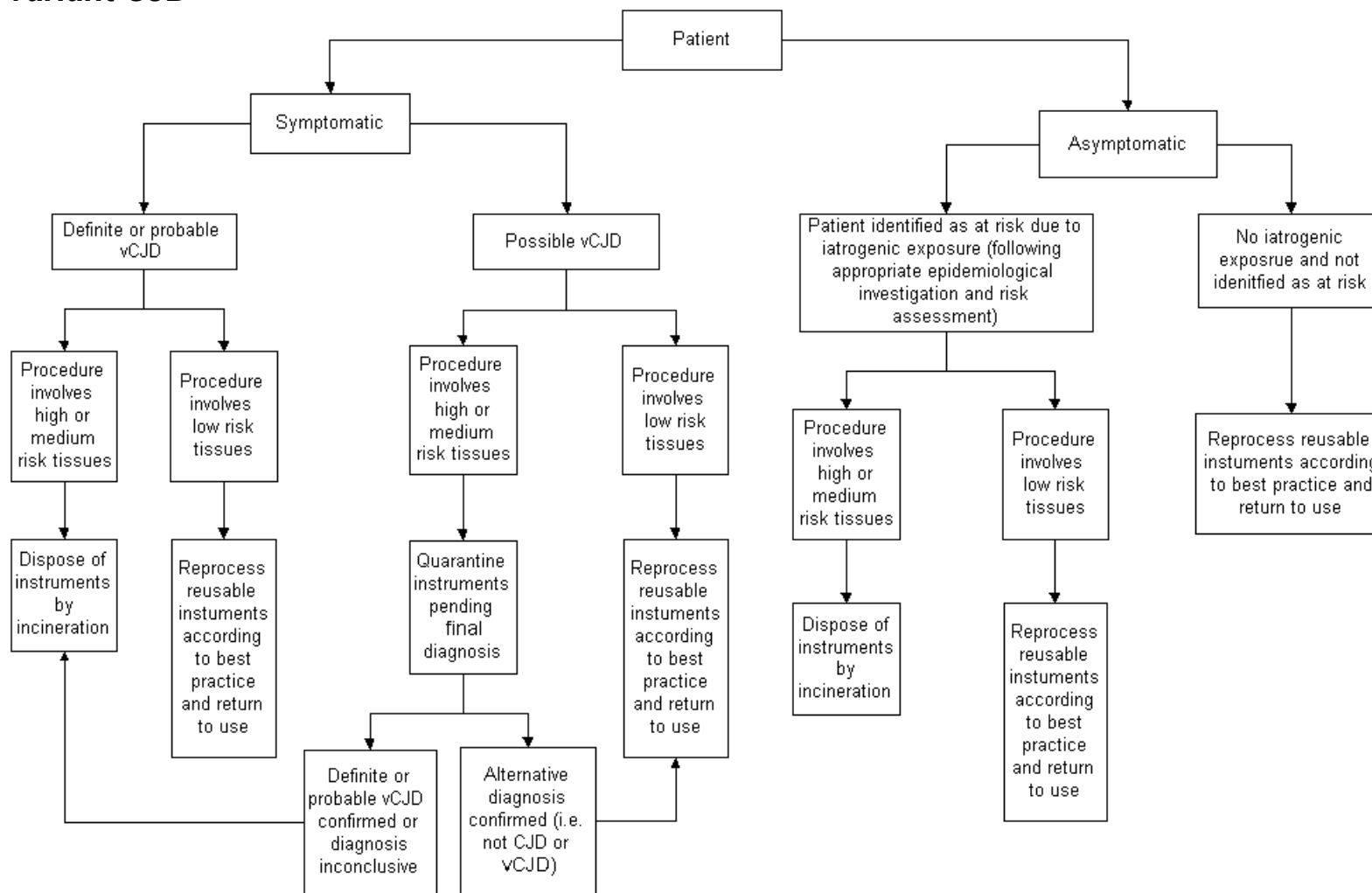


Figure 3.2 : Flow chart for precautions for surgical procedures on known, suspect or at risk patients: variant CJD



Chapter 4: Decontamination of Medical Devices

4.1: Physical Cleaning of Instruments

Cleaning of surgical instruments is an essential pre-requisite to ensure effective disinfection and/or sterilisation [17]. The presence of organic matter on medical devices inhibits the contact of disinfectant or sterilant with microbial cells and reduces their activity and effectiveness.

Automated washing methods are preferred and provide a number of advantages over manual methods, including provision of efficient, reproducible processes that can be readily controlled and validated, and protection for the user in reducing exposure to chemicals and microorganisms.

Reprocessing of instruments should be undertaken outside of the clinical environment, where possible, and preferably in central processing units. Instruments, devices and associated accessories should be decontaminated immediately following use or as soon as is reasonably practicable. This is particularly important for hollow or channelled instruments, such as endoscopes, where organic material may dry within channels.

All surgical instruments that are used in the clinical environment must be decontaminated without exception.

4.1.1: Automated physical cleaning of instruments

Instruments should initially be treated in a covered ultrasonic cleaner for a minimum of three minutes, following manufacturer's recommendations. An enzyme-based detergent, containing proteolytic enzymes and propylene glycol, should be included in the ultrasonic cleaning step. There is no need to have a dedicated ultrasonic cleaner for instruments used on patients with a known or suspected TSE. The ultrasonic cleaner should, however, be run on an empty cycle after processing such instruments and prior to processing any further instruments.

After ultrasonic cleaning instruments should be treated in an automated thermal washer-disinfector. Neutral or enzymatic detergent suitable for use with this processing equipment should be used. Where instruments have contacted high or medium risk tissues, in the setting of a known or suspected TSE, no other instruments should be included in the washing cycles.

Washer-disinfectors should comply with international standards for technical requirements, maintenance, in-use testing etc. At present there are no approved EU standards relating to washer-disinfectors. Standards are being developed by the CEN technical committee TC 102 and will shortly be available from the CEN on-line catalogue at www.cenorm.be/catweb. British Standard 2745:1993 also specifies requirements for washer-disinfectors used for medical purposes.

Instruments that have been quarantined and are being reprocessed, once a TSE has been excluded, should also undergo automated physical cleaning, even if they were cleaned prior to quarantine.

4.1.2: Manual cleaning of instruments

If manual cleaning of instruments is required the following environmental controls must be in place to minimise the possibility of recontamination following the cleaning and disinfection processes:

- The area to be used for manual cleaning should be dedicated for the purpose and not shared with other activities.
- Personal Protective Equipment for staff undertaking manual cleaning e.g. gloves, waterproof apron and goggles or visor must be readily available.
- Eye protection (goggles or visor) must be used when operating jet guns.
- A first aid kit and eye wash bottle must be available nearby.
- A dedicated sink (not hand wash basin), containing water/detergent mixture, should be used for cleaning instruments.
- A second dedicated sink (not hand wash basin) should be used for rinsing items.
- A supply of cleaning implements and accessories (brushes, cloths etc.) should be readily available. These should follow the recommendations for cleaning provided by the instrument manufacturers.
- The cleaning implements should be routinely decontaminated or discarded at a frequency determined by a documented local policy.
- A clean, disposable, absorbent, non-shedding cloth for hand drying items or a mechanical drying facility should be available.
- Cleaning materials should be safely disposed of in accordance with local policy in the appropriate waste containers following use.
- Jet guns should only be connected to the cold water supply.

Manual cleaning should be undertaken using an immersion technique, wherever possible.

Procedure for Manual Cleaning

To minimise the risk to personnel undertaking manual cleaning, splashing and the creation of aerosols must be avoided at all times.

- a) Fill the clean sink (not hand wash basin) with water and detergent (detergent dilution and water temperature should be in accordance with manufacturers' instructions and/or local documented policy/procedures)
- b) Wearing protective clothing, dismantle or open the instrument to be cleaned and fully immerse in the solution in order to displace trapped air and to ensure penetration of the lumen if hollow instruments are being cleaned. Consideration should be given to the use of a protein-enzyme dissolving solution when cleaning medical devices with lumens or complex parts.
- c) Brush, wipe, agitate, irrigate, jetwash or hand spray the item to dislodge and remove all visible soil, taking care to ensure the item remains under the surface of the water at all times to prevent the creation of aerosols.

- d) Remove the item from the sink and drain any excess detergent prior to placing in the second sink to rinse in clean water
- e) Rinse the item thoroughly with clean water or water jet gun under the surface of the water.
- f) Remove and drain the item before drying using the preferred method.
- g) Complete any necessary documentation to record the item being processed and the method and solutions employed.

If either the cleaning solution or the rinse water becomes obviously soiled or contaminated, it should be changed and the process repeated. Wastewater should be disposed of according to local policy.

Non-immersion hand washing methods are appropriate for certain equipment where items will become compromised by soaking in aqueous solutions, e.g. electrical and electronic equipment. These items should be cleaned in accordance with manufacturers' instructions.

Further advice should be sought from the local Infection Control Team.

4.2: Thermal and chemical prion inactivation

Following manual or automated physical cleaning of instruments it is essential that instruments undergo effective thermal or chemical decontamination. Thermal means (i.e. autoclaving) are preferred where possible.

Previous guidance recommended the use of "TSE-inactivating procedures", as listed in table 4.1. However, recent evidence has shown that such methods may be ineffective and may even render prions more resistant to further inactivation (see section 2.3). A list of ineffective or partially effective decontamination methods for TSE-infectious material is given in table 4.2.

4.2.1: Thermal Inactivation

Prions are not completely inactivated by standard thermal methods of sterilisation, though studies suggest that only a fraction of the infectious activity is highly resistant to thermal inactivation [17,25]

In most situations the standard autoclave protocol of 135°C for 3-5 minutes should be sufficient to effectively eliminate prion infectivity, assuming instruments have been thoroughly cleaned beforehand. The only exceptions to this would be situations where the potential level of tissue prion infectivity is too high to allow for effective decontamination using standard protocols, as detailed in section 3.3.

The combination of sodium hydroxide with steam sterilisation has been investigated and recommended in some international guidelines [25]. However this combination is likely to be too corrosive for routine use on instruments, as well as posing a risk to CSSD staff through potential exposure to hot sodium hydroxide solution.

The most effective means of inactivation of prions is incineration and this should be used for all disposable instruments, materials and wastes.

4.2.2: Treatment of Instruments with Liquid Chemicals

If an instrument is unable to tolerate the moist heat porous load cycle specified, then liquid chemical treatment may be considered.

Chemical agents and contact times that have been found to be most effective include:

- 20,000ppm available chlorine of sodium hypochlorite for 1 hour.
- 2M sodium hydroxide for 1 hour.

Histology samples may be decontaminated using 96% formic acid for 60 minutes (see section C.3 for details).

Note: 10,000ppm hypochlorite must not be used, as it is ineffective against TSE agents at this concentration.

Manufacturers of CE-marked re-usable medical devices are required to supply information on the appropriate processes to allow re-use. Users should consult this information to ensure that the instruments are able to withstand the required decontamination processes, which are more rigorous than the processes normally used for re-processing.

4.2.3: Decontamination of surfaces

Surfaces which have been contaminated with potentially TSE-infectious material should be physically cleaned (as described in section C.3.) and then flooded with 2M sodium hydroxide (NaOH) or undiluted sodium hypochlorite. This should be left in place for one hour then mopped up and rinsed with water.

Where surfaces cannot tolerate sodium hydroxide or hypochlorite thorough cleaning will remove most infectivity by dilution. Some additional benefit may be gained by using one or more of the partially effective methods listed in table 4.2.

Table 4.1: Previously recommended “TSE-inactivating protocols”

Chemical inactivation	Thermal inactivation
Sodium hypochlorite (20,000ppm available chlorine) for 60 minutes	Porous load (pre-vacuum) steam steriliser (autoclave) at 134-137°C for 18 minutes (preferred method)
2M sodium hydroxide for 60 minutes	
96% formic acid for 60 minutes (for histology/pathology specimens only)	Gravity displacement autoclave at 121-132°C for 60 minutes

Table 4.2: Ineffective and partially effective methods for inactivation of prions

Chemical disinfectants	Gaseous disinfectants	Physical processes
<p><i>Ineffective</i></p> <p>Alcohols Ammonia β-propiolactone Formalin Hydrochloric acid Hydrogen peroxide Peracetic acid Phenolics Sodium dodecyl sulphate (SDS) 5%</p> <p><i>Variably or partially effective</i></p> <p>Chlorine dioxide Gluteraldehyde Guanidinium thiocyanate (4M) Iodophores Sodium dichloro-isocyanurate Sodium metaperiodate Urea (6M)</p>	<p><i>Ineffective</i></p> <p>Ethylene oxide Formaldehyde</p>	<p><i>Ineffective</i></p> <p>Boiling Dry heat (<300°C) Ionising, UV or microwave radiation</p> <p><i>Variably or partially effective</i></p> <p>Autoclaving at 121°C for 15 minutes Boiling in 3% sodium dodecyl sulphate (SDS)</p>

Chapter 5: Instrument Quarantine

Where single use instruments are not available for procedures on patients with suspected TSE instruments need to be quarantined, pending a definitive diagnosis. Institutions that are likely to carry out high-risk procedures should have a written instrument quarantine policy.

5.1: Responsible person

If an institution is likely to carry out procedures on suspected TSE cases a person should be nominated with responsibility to coordinate the handling and decontamination of devices used for such procedures. In most instances this should be the CSSD director. The clinical nurse manager with responsibility for handling of equipment in the operating theatre should coordinate with the CSSD manager pre and post-operatively to ensure safe handling and decontamination of the devices used.

5.2: Designated area for quarantine

The quarantined instruments must be stored in a secure area, ideally within or adjacent to CSSD. The area should be kept locked and persons with access to the area kept to a minimum. The storage area must be separated from areas used to store instruments that have been reprocessed or are awaiting routine reprocessing.

Instruments that have been designated for use only on patients with TSEs, such as gastrointestinal endoscopes previously used on a patient with vCJD, should be stored in a separate area, away from instruments quarantined pending a TSE diagnosis.

5.3: Pre-operative preparation

The person designated as being responsible for overseeing the quarantine process should meet with the chief operator prior to the procedure. The container designated for storing the quarantined instruments should be pre-labelled with the patient's name and hospital identification number and should be clearly labelled as being for quarantine use only. The container must be available in the operating theatre.

5.4: Handling prior to cleaning

Instruments should be placed in an approved leak proof container and kept moist prior to transfer to CSSD. Detergents or disinfectants should not be added to the container prior to transfer to CSSD, as these could potentially damage the instruments or act as protein fixatives.

5.5: Physical cleaning of instruments prior to quarantine

Instruments should be physically cleaned prior to quarantine, using automated methods where possible (see chapter 4). The washer-disinfector should be run on an empty cycle prior to further use.

After cleaning instruments should be placed on a disposable instrument tray and allowed to air dry, before being transferred to a sturdy, leak proof container for quarantine, as detailed above.

Flexible endoscopes should be cleaned immediately after use and decontaminated using standard methodologies, as detailed in Appendix C, prior to quarantine.

5.6: Containers used for quarantine

The containers used for quarantine should be large enough to fit all of the devices used for an individual procedure. The containers must be rigid, leak-proof, spill-proof, sturdy and capable of being securely sealed. Rigid plastic containers, such as those produced by suppliers of medical waste containers, are likely to be most suitable. The containers should comply with UN/ADR test standards and should not be filled to more than three-quarters full. The container should be destroyed by incineration after use.

5.7: Labelling of containers

Containers must be clearly labelled as containing instruments suspected of being contaminated with TSE agent. The label should contain the following information:

- Date of procedure
- Type of procedure
- Risk category of procedure (see chapter 3)
- Clinician responsible for the patient's care
- Patient name, date of birth and hospital identification number
- Number of instruments in container
- Type of instruments in container
- Identification number(s) of instrument(s) or instrument set, based on local instrument tracking system
- Identification number of container
- Whether the instruments were manually cleaned prior to quarantine or placed directly into quarantine container
- Name and contact details of designated person with responsibility for instrument quarantine
- Indicate whether the instruments are quarantined pending a final diagnosis or have been quarantined following use on a known TSE case and being held for further use only on known TSE cases

5.8: Documentation

Clear documentation must be completed for each procedure requiring instrument quarantine. This should include details of the following:

- Patient name, date of birth and hospital identification number
- Date and time of procedure
- Nature of procedure
- Name of operator
- Name/identification number of instrument or instrument kit/set used
- List of instruments included in container
- Storage location

- Identification number of container
- Date of final diagnosis
- Details of final diagnosis
- If TSE confirmed
- Date container and instruments sent for incineration
- Confirmation that all of the instruments listed for quarantine were present in the container prior to incineration
- If alternative diagnosis confirmed
- Date instruments sent for cleaning and decontamination
- Confirmation that instruments used for invasive procedures on high or moderate risk tissues were processed using a recommended TSE-inactivating method
- Date quarantine container sent for incineration

The designated person with responsibility for instrument quarantine is responsible for ensuring that documentation is completed for each stage of instrument quarantine. Copies of the documentation should be securely held by the responsible person and by hospital administration. A complete report should be prepared once the fate of the quarantined instrument(s) is finalised. Copies of the final report should be submitted to the medical/surgical executive (depending on the initial procedure type), hospital infection control committee, CSSD manager, theatre clinical nurse manager, theatre superintendent and hospital administration.

Quarantined instruments should not be removed from quarantine until a full report has been submitted to the relevant responsible persons.

Chapter 6: Instrument Tracking

6.1: Current Traceability Systems

Modern tracking systems have the ability to trace surgical instruments throughout their life cycles. Some tracking systems can also incorporate information on the instruments whilst in the repair cycle.

The choice of product should fit with the needs of the particular organisation and the risks associated with procedures being carried out there. Most traceability packages are available from instrument manufacturers and systems' integrators. All of the systems offer some method of tracking either the actual instrument sets or containers as well as providing a variety of instrument, other asset and staff management tools.

6.1.1: *Basic instrument tracing*

This is a system that allows instruments to be traced to steriliser load. This is achieved through the use of instrument labels that contain the following information:

- Steriliser load number **or** process number. Every steriliser should have a built in facility to allocate sequential load numbers so that no two loads have the same process number. (If this facility is not available on the steriliser, a unique number should be allocated to each cycle performed, including test cycles.)
- Date of sterilisation
- Number to identify which steriliser was used if there is more than one steriliser in department.
- Optional chemically integrated strip which changes colour upon sterilisation.

Each instrument or set of instruments is labelled prior to sterilisation using pre-printed labels. A record is kept of each labelled item to go into that particular load. A logbook is assigned to each steriliser, which contains details of all loads processed, including the process number per load.

At the point of use the labels from each individual item used on the patient must be recorded in the patient's notes. Most labels are designed so that they adhere to the pack but can be removed at the point of use to go into the patients' notes.

The success of this system depends on saving of instrument labels and the correct storage of them in the patient's notes.

The disadvantages of this system include:

- Time spent affixing labels prior to sterilisation and amounts of labels generated.
- In some institutions most instruments are single supplementary items and do not have a unique identifier. Thus, for example, it may be impossible to say exactly which suction tip was used on a particular patient if there are 500 of them in circulation, despite all of the information on sterilisation and all labels being inserted in patients' charts.

- Every item used on a patient must have a label and this label must be put into the notes. If the patient has more than one visit to theatre/clinic there may be large amounts of labels for storage leading to bulky records.
- Commercially sterilised single use items cannot be recorded.
- Staff must undergo extensive training
- Labels may not be recorded in the case of emergency procedures
- Such systems do not provide a means of recording decontamination procedures.
- Labels may fall off prior to arriving at point of use.
- Incorrect labelling of instruments may occur through human error

Basic instrument tracing is an ideal system as a starting point towards full traceability as no changes need to be made to existing instruments. There is no marking of instruments involved. However, it is always advisable to allocate set numbers to sets of instruments, particularly if there is more than one of each type of set. This can be done by means of engraving or colour coding.

6.1.2: Advanced full traceability systems

There are many systems available commercially which allow individual instruments and sets of instruments to be tracked through the whole reprocessing system. All of the modern systems are computerised and include a set of computer applications specifically designed to record the work process in the sterile supplies unit step by step and relate this information to the individual patient/patients they subsequently get used on.

The identity of the item is assigned during packing: a label is generated with a barcode, which is placed on the outside of the pack. A record of date and time of production is kept in the computer database relating to this pack. In most computerised systems this label can also contain information confirming decontamination has taken place. All locations are also identified with a unique barcode so those instruments can be traced to a location at any time. Instruments can be scanned into and out of different locations.

Most of these systems are compatible where sets of instruments are used and each set can be easily identified. This presumes, however, that no instrument will ever be removed from that set for repair or replacement and it cannot control instruments becoming separated during decontamination.

Software packages for traceability should be capable of interfacing with other hospital information technology systems.

6.1.3: Tracking of individual instruments

Label-based approaches do not have the facility to isolate individual items nor do they have the ability to track decontamination procedures. In order to track individual items they must be marked individually using one of the currently available systems. These include:

- Laser etching

- 2-D Data matrix code
- Bar coding
- RFID (Radio Frequency Identification)

All of these marking systems have a dual function in that they also allow the system to create a profile for each instrument with details on cost, supplier, care of instrument, sterilising instructions etc. available within the tracking system. The applicability of these marking systems to an individual organisation will depend on the volume of instruments in circulation. It does require individually marking each instrument and scanning each one individually throughout the whole process, but is the only means available presently for tracking single supplementary items.

6.3: Conclusion

At present in Ireland there is no legislation governing the tracking of surgical instruments through the whole decontamination / sterilisation cycle. However there are recommendations for the tracking of flexible endoscopes. This does not allow for other widely used surgical instruments and equipment to be tracked.

There must be a system in place in every clinical organisation which allows a method of demonstrating instrument decontamination, sterilisation and also to easily link these processes to instruments eventually used on the patient.

All organisations carrying out reprocessing of medical devices must have some form of instrument tracking in place, even if they are not carrying out moderate or high-risk procedures relating to TSEs. The benefits of effective instrument tracking go beyond issues related to TSEs.

In deciding what form of instrument tracking should be adopted each institution should carry out a risk assessment, taking account of the following factors:

- Number of instruments reprocessed each year
- Number of single supplementary items reprocessed
- Whether or not moderate or high risk procedures, relating to TSEs, are carried out and, if so, how many are likely to require single supplementary items
- Current CSSD protocols, staffing, equipment, information technology etc.
- Current or planned hospital information systems

Each Health Board/Authority, in conjunction with individual institutions, must ensure that appropriate instrument tracking systems are in place in each institution carrying out reprocessing of medical devices. Priority should be given to institutions likely to carry out high or moderate TSE risk procedures.

Chapter 7: Management of Clinical Procedures and Administrative Issues

7.1: Identification of patients at increased risk of TSE

Patients who are due to undergo a procedure involving high-infectivity or medium-infectivity tissues must be questioned pre-operatively and have their medical records searched to determine if they are at increased risk of developing a TSE, as outlined in section 2.5. This must be documented in the patient's medical records, even if definitive answers cannot be given to some or all of the questions.

7.2: Dedicated instrument sets

Dedicated instrument sets should be used for procedures on high or medium risk tissues. Each set should only be used for specified procedures or for contact with specified tissue and not used for other purposes. For example, an instrument set dedicated for tonsillectomy should not be used for other surgical procedures. Using dedicated instrument sets facilitates instrument tracking and investigation of possible exposures to contaminated instruments (see Appendix G).

7.3: Procedures on patients with a known or suspected TSE

7.3.1: Pre-operative care

The local microbiologist/infection control team must be informed if a patient with known or suspected TSE is admitted to a hospital or other healthcare facility. If any procedure is planned on the patient then the theatre director, CSSD, surgical directorate and pathology department must also be informed. Written protocols should be in place for managing the procedure itself, as well as other practicalities such as instrument handling, cleaning, decontamination and disposal. All staff directly involved in the procedure, in the re-processing or disposal of potentially contaminated items or in handling laboratory specimens resulting from the procedure must be aware of, and have relevant training in, the recommended precautions. All relevant staff in these areas must be informed of the proposed procedure in sufficient time to allow for planning, protocol review and acquisition of suitable instruments and equipment, if required.

It is the responsibility of the senior clinician in charge of the patient's care to ensure that the relevant personnel are informed prior to any procedure.

The following checklist lists the personnel that may need to be informed and/or provided with written protocols when procedures are planned on known or suspected TSE cases:

- Hospital/health care institution CEO
- CSSD manager
- Microbiologist
- Infection control nurse
- Infection control committee
- Chief/director of surgery
- Chief/director of medicine
- Director of nursing
- Theatre clinical nurse manager
- Theatre superintendent
- Operating theatre or endoscopy unit manager
- Environmental cleaning supervisor
- Waste management supervisor
- Laboratory director

In an emergency setting it will be difficult to ensure that all of the above precautionary steps are taken prior to surgery. Surgery should be delayed, if possible, but not at the expense of patient well-being. Where surgery cannot be delayed the relevant personnel should be informed as soon as is practicable. It is important that institutions that are likely to carry out procedures on patients with a known or suspected TSE have clear written guidelines on pre-operative care for such patients in place.

7.3.2: Intra-operative care

Operative procedures on known or suspected cases of TSE should only be performed in an operating theatre and should be placed at the end of the operating list, to allow for cleaning and disposal of healthcare risk waste.

Hospitals that are likely to be performing high-risk procedures on known or suspected cases of TSE should consider having dedicated minimal instrument sets available to reduce the number of reusable instruments that will need to be quarantined or destroyed. Partial instrument sets should be used if possible. Such institutions will need to consider having contingency funding in place to ensure that sufficient single-use instruments are available and that reusable instruments that have to be destroyed can be quickly replaced.

Reusable instruments used for procedures on patients with a known or suspected TSE should be kept moist throughout the procedure. This may be achieved by placing instruments that will be reused during the procedure into sterile dishes containing enough sterile water to immerse the instruments. Alternatively instruments may be placed on sterile towelling, swabs or other absorbent material and periodically irrigated with sterile water while not in use, or kept between layers of absorbent material soaked with sterile water.

Single use instruments should be separated from reusable instruments at the end of the procedure.

The procedure should involve only the minimum required number of healthcare personnel.

Operative personnel should wear a liquid-repellant operating gown, worn over a plastic apron, gloves, mask and eye protection (visor or goggles). All of these items, along with linens and drapes used during the procedure, should be single-use items. All single-use items should be bagged, clearly marked with a “Biohazard” label and destroyed by incineration.

A one-way flow of instruments should be maintained.

All laboratory samples should be clearly labelled with a “Biohazard” label and the relevant laboratories informed of the nature and number of samples being sent.

Instruments that have been in contact with high or moderate infectivity tissues should be kept separate from those that have been in contact with low-risk tissues.

All non-disposable, non-sterilisable equipment should be masked with disposable drapes to protect it from splashes. All work surfaces should be covered with disposable material, which should be removed and incinerated after use.

All items for disposal by incineration should be placed in a rigid plastic waste container, clearly labelled as “Biohazard”, and transported to the incinerator as soon as practicable.

7.4: Complex instruments

Some expensive items of equipment, such as drills, may be shielded during procedures to prevent contamination during high-risk procedures. The drill bit, other parts in contact with high-risk tissue and the protective coverings should all be destroyed by incineration. In practice it may be difficult to ensure effective protection of complex instruments and local protocols should be put in place, following consultation with surgical staff and instrument manufacturers to determine practicality.

7.5: Indicators of good practice for decontamination procedures

The following are indicators of good practice in relation to decontamination of medical devices, which have been adapted from the Scottish Health and Safety Executive’s review of decontamination procedures [26]:

- One senior manager should be responsible for maintaining an overview of decontamination procedures and should report directly to the hospital CEO. In most institutions this will be the CSSD manager.
- Managers of CSSDs and clinical departments carrying out decontamination procedures should have documented defined roles and responsibilities relating to decontamination procedures.

- Each hospital should have an infection control committee in place, which should regularly review issues relating to decontamination of medical devices within the institution.
- Hospitals should carry out risk assessments to identify hazards related to decontamination procedures within their own institution.
- Infection control policies should be in place, and should contain specific guidance on decontamination and TSEs.
- Hospitals should have a documented policy on the procurement of medical devices and decontamination equipment.
- Hospitals should have regular audits of all aspects of decontamination procedures, including procedures carried out outside of CSSD.
- There should be documentary evidence that staff involved in decontamination procedures have received relevant training, particularly in relation to manual cleaning, quarantine and TSE decontamination procedures.

Other indicators of good practice relate specifically to CSSDs:

- CSSDs should have adequate environmental controls to reduce microbial or particulate contamination
- CSSDs should have automated washer-disinfectors
- A dedicated sink should be available for manual cleaning of instruments
- Manual cleaning should be carried out using an immersion method (see section 4.1.2)
- Staff involved in instrument cleaning should use personal protective equipment, including eye protection
- Washer-disinfectors should be regularly validated to ensure they meet pressure, time and temperature requirements
- Documented monitoring of each washer-disinfector cycle should be in place to ensure pressure, time and temperature requirements are met
- Washer-disinfectors should be regularly maintained to ensure safe and efficient operation
- Clean and sterilised items should be packaged in an area away from contaminated items

CSSDs, and any other department carrying out decontamination of medical devices, must comply with European medical devices Directive 93/42/EEC and other relevant Directives.

7.6: Guideline implementation

All institutions carrying out procedures where TSE transmission is a possibility or engaged in reprocessing of reusable medical devices should designate a responsible person to oversee the implementation of these guidelines within their institution. This person should be accountable to the administrator of the institution and to the local infection control committee. Their remit will include:

- Assessing implications of the guidelines for their institution
- Identifying systems currently in place
- Identifying gaps that need to be addressed
- Ensuring an appropriate instrument tracking system is put in place

- Ensuring that written protocols are in place for preventing nosocomial transmission of TSEs
- Monitoring progress with guideline implementation and auditing procedures and protocols

Each Health Board/Authority will also need to designate a person with similar responsibilities at regional level.

Chapter 8: Audit of Decontamination Procedures

8.1: National audit of decontamination procedures

The guidelines regarding decontamination of instruments potentially contaminated with TSE agents detailed in this document assume that decontamination procedures are properly carried out and that departments responsible for decontamination follow the indicators of good practice outlined in section 7.3. In order to ensure that decontamination of medical devices is properly carried out the subcommittee recommends that a national audit of decontamination procedures is carried out. Systems need to be put in place to ensure that any deficiencies identified in such an audit can be quickly corrected.

The purpose of this audit will be:

- To identify and document deficiencies in decontamination practice in Ireland
- To determine if there are practical difficulties in ensuring good practice
- To determine what measures need to be taken to improve decontamination procedures in Ireland

The results of the audit will be used to:

- Correct deficiencies in decontamination practice
- Alert hospital and other healthcare administrators to potential problems with decontamination within their own institutions
- Update the TSE infection control guidelines

The national audit of decontamination procedures should be carried out after these guidelines have been distributed and after allowing sufficient time for institutions to comply with the guidelines. The audit should be similar to the national audit recently carried out by the Scottish Executive Health Department [26].

8.1.1: Administration

A national audit of decontamination procedures will require significant funding and organisation. The remit of the audit will go beyond decontamination issues relating to TSEs: all areas of instrument decontamination and reprocessing should be examined. It is also important that the findings of the audit will be acted upon and that any deficiencies are rectified. For these reasons the audit working group should be set up as a DOHC committee.

The audit working group should include representatives from clinical microbiology, infection control (infection control doctor and infection control nurse), CSSD management, surgery, dentistry, general practice, hospital engineering, hospital administration, operating theatre management, public health, National CJD Advisory Committee, NDSC and DOHC.

The working group should coordinate the design, planning, execution and analysis of the audit.

8.1.2: Audit methodology

The working group should appoint assessors to carry out the audit process in individual institutions. The assessors will need to be properly trained prior to carrying out the audit. A number of assessors will need to visit each healthcare site and data should be collected using standardised data collection forms. Assessors will need to visit all areas within an institution where instruments are either decontaminated or used. They will also need to interview all key personnel involved in the decontamination process, including the chair of the local infection control committee, clinical microbiologists, infection control doctors and nurses, CSSD manager, hospital administration and managers of clinical departments. The assessors will need training in medical device auditing and should have knowledge of relevant European medical device directives.

8.1.3: Selection of sites for audit

It will not be feasible to carry out a detailed audit in every healthcare institution in the country and, thus, a selection of health care sites should be chosen. These should represent a cross section of Irish healthcare institutions and should include local, regional and tertiary hospitals, private hospitals, general medical practices, general dental practices, dental hospital and other sites carrying out decontamination procedures.

8.2: Local audit of decontamination procedures

Hospital and other healthcare administrators should carry out an audit of decontamination procedures within their own institution or jurisdiction. Such local audit should use the same indicators of good practice as in the national audit (see section 7.3). The local infection control committee should coordinate the local audit.

Appendix A: Diagnostic Criteria for TSEs

The risk of iatrogenic transmission of TSEs is highest from patients who have symptoms suggestive of a TSE. Symptomatic patients are those who fulfil internationally accepted diagnostic criteria for TSEs, as detailed below. Symptomatic patients are classified as either **definite**, **probable** or **possible** CJD or vCJD.

A1: Sporadic CJD

- Neuropathological/immunocytochemical confirmation is required for a diagnosis of **definite** sporadic CJD.
- **Probable** sporadic CJD patients will have rapidly progressive dementia, **and** at least two of the following four symptoms:
 - (a) myoclonus
 - (b) visual or cerebellar problems
 - (c) pyramidal or extrapyramidal features
 - (d) akinetic mutism
 - **plus** typical electroencephalogram (EEG) with generalised triphasic periodic complexes at approximately 1 per second,
 - **or** clinical criteria for **possible** sporadic CJD (see below) and a positive assay for 14-3-3 protein in the cerebrospinal fluid (CSF).
- **Possible** sporadic CJD patients will have rapidly progressive dementia, two of the four symptoms listed above **and** a duration of symptoms of less than 2 years.

A2: Iatrogenic CJD

- Iatrogenic CJD patients display progressive cerebellar syndrome in a pituitary hormone recipient **or** sporadic CJD with a recognised exposure risk.
- Recognised exposure risks, in descending order of risk, are:
 - Receipt of human pituitary-derived hormone
 - Receipt of *dura mater* graft
 - Exposure to instruments used on, or receipt of blood, plasma derivatives, organs or tissues donated by, a patient who went on to develop CJD or vCJD (Note: such exposures can only be classified as an exposure risk following appropriate look-back investigations and risk assessment)
- A **definite** diagnosis of iatrogenic CJD still requires neuropathological/immunocytochemical confirmation.

A3: Familial CJD

- Patients with familial CJD will have **definite** or **probable** CJD (see definitions in section E1 above), plus **definite** or **probable** CJD in a first degree relative (*i.e.* a parent, child or sibling)
- **or** a neuropsychiatric disorder plus a disease-specific mutation in the prion

protein gene.

A4: variant CJD (vCJD)

- **Definite** vCJD patients will have a progressive neuropsychiatric disorder **and** neuropathological confirmation of the disease, showing spongiform change and extensive PrPC (should this be PrP^{Sc}?) deposition with florid plaques throughout the cerebrum and cerebellum.
- **Probable** vCJD patients can be classified under two sets of criteria:
 - **Criteria 1:**
 - A **probable** vCJD patient will have progressive neuropsychiatric disorder of a duration greater than 6 months where routine investigations do not suggest an alternative diagnosis. They will **also** have at least four of the following five symptoms:
 - (a) early psychiatric symptoms (depression, anxiety, apathy, withdrawal, delusions)
 - (b) persistent painful sensory symptoms (including both frank pain and/or unpleasant dysaesthesia)
 - (c) ataxia
 - (d) myoclonus or chorea or dystonia
 - (e) dementia
 - An EEG will not show the typical appearances of sporadic CJD, **or** no EEG has been done **and** there is a symmetrical high signal in the posterior thalamus on a MRI brain scan.
 - These patients would have had no history of potential iatrogenic exposure.
 - **Criteria 2:**
 - A **probable** vCJD patient will have had a progressive neuropsychiatric disorder for a period of longer than six months, where routine investigations do not support an alternative diagnosis, and where there is no history of potential of iatrogenic exposure, **plus** a positive tonsil biopsy which is positive for PrP-res.
- **Possible** vCJD patients will have progressive neuropsychiatric disorder of a duration greater than 6 months where routine investigations do not suggest an alternative diagnosis, and no history of potential iatrogenic exposure. They will **also** have at least four out of five of the symptoms listed above (under **Criteria 1**) and an EEG does not show the typical appearance of sporadic CJD **or** no EEG has been performed.

A5: Patients who do not fulfil the criteria for *possible* CJD

The UK National CJD Surveillance Unit (NCJDSU) have designated three additional categories for patients who are referred to the Unit but who do not meet the criteria for **possible** CJD.

These can be summarised as:

1. **Diagnosis unclear** –the diagnostic criteria for **definite**, **probable** or **possible** CJD are not met, **nor** is there a reasonable alternative diagnosis. CJD,

- therefore, remains a possibility;
2. **CJD thought unlikely** – information indicates that a clinical diagnosis of CJD is very unlikely because of atypical disease features, and/or an atypical course, and/or atypical clinical investigation results, and/or a reasonable alternative diagnosis is made but is not confirmed. This category includes cases which recover clinically without a firm alternative diagnosis;
 3. **Definitely not CJD** – information indicates that CJD is not the diagnosis **and** there is an alternative definite diagnosis proven on the basis of clinical examination, clinical investigations or pathology.

Appendix B: Dental Procedures

No iatrogenic cases of CJD have been linked to dental procedures and there is no evidence of TSE infectivity, including vCJD, in dental tissues. However infectivity has been demonstrated in the dental tissue of scrapie-infected hamsters, though at levels that were lower than in the trigeminal ganglia [27]. Studies on scrapie-infected mice showed that gingival tissues are infective, though experimental transmission was only achieved with difficulty [28]. Prion protein could not be detected in dental pulp from patients with sporadic CJD in one recent study [29].

A UK risk assessment for vCJD and dentistry concluded that accidental abrasion of the tonsils during dental procedures represented the only significant risk but that the risk of transmission would be remote. Compared to tonsillectomy a single dental procedure on an infective patient would be about 1,000,000,000 times less likely to transmit vCJD. Even with very pessimistic assumptions about the chances of tissue abrasion the risk would still be 10,000 times lower [30]. On the basis of this risk assessment dental procedures can be considered low risk, assuming optimal standards of infection control and instrument decontamination are maintained.

For patients who do not have a known or suspected TSE routine infection control precautions are sufficient for dental procedures. However, particular attention should be paid to the following precautions:

- Re-usable dental instruments, such as broaches, reamers and burs that may have become contaminated with neurovascular tissue must be thoroughly physically cleaned and decontaminated using standard protocols prior to reuse.
- Procedures that are likely to involve contact with neurovascular tissue should, if possible, be scheduled for the end of the surgical list, to allow time for appropriate cleaning and decontamination of instruments.

Although there is no evidence of increased risk associated with dental procedures on known or suspected TSE cases the following precautions are recommended:

- Single-use instruments should be used wherever possible and destroyed by incineration.
- Hand pieces should not be attached to the dental unit water supply since, in spite of anti-retraction valves, there is a remote possibility that potentially infected clinical material could be drawn into the water supply line. If water cooling is required it should be administered using a syringe.
- A portable suction unit, with a disposable reservoir, should be used.
- Patients should rinse their mouth into a disposable bowl, rather than the cupsidor.

If dental procedures involving neurovascular tissue are carried out the dental practice must have access to facilities to allow thorough cleaning of instruments and effective decontamination procedures, as detailed in chapter 4. If such facilities are not available on site disposable instruments should be used for such procedures.

Maxillo-facial procedures involving the eye or CNS should be undertaken with regard to the recommendations in Chapter 3.

Appendix C: Endoscopy

The risk of endoscopes or endoscopic accessories contacting TSE infective tissue is small, as is the risk of further endoscopic transmission of TSEs by the mucosal route. However, flexible endoscopes are not capable of withstanding heat-sterilisation protocols. Thus, for some clinical situations, the risk of transmission cannot be entirely eliminated and endoscopes may need to be quarantined or destroyed.

These situations mainly arise in the setting of vCJD. For vCJD, unlike other TSEs, infectivity may be widely distributed outside of the CNS and ocular tissues. Infectivity levels may be particularly high in lymphoid tissue, particularly the tonsils, adenoids and, possibly, other lymphoid tissue lining the gastrointestinal tract. Thus the highest risk of transmission will be with gastrointestinal and otolaryngological endoscopy. Altered prion protein has been detected in the olfactory epithelium of patients with sporadic CJD.

C1: TSEs other than vCJD

C.1.1: Symptomatic TSE (definite or probable), other than vCJD

Neurological endoscopes, in the rare instance that they would be used in such cases, cannot be effectively decontaminated and must be destroyed after use.

If the risk of contamination with olfactory epithelium cannot be excluded with confidence, endoscopes entering the nasal cavity must be destroyed after use.

For all other types of endoscopy standard decontamination procedures should be followed and the endoscope returned to use.

C.1.2: Symptomatic TSE (possible or diagnosis unclear), other than vCJD

Neurological endoscopes, in the rare instance that they would be used in such cases, should be single use where possible. A reusable endoscope may be quarantined, pending final diagnosis (see chapter 5). The quarantined endoscope may be reused exclusively on the same patient if required. If a TSE is confirmed or cannot be excluded, the endoscope must be destroyed.

If the risk of contamination with olfactory epithelium cannot be excluded with confidence, endoscopes entering the nasal cavity should be single use where possible. A reusable endoscope may be quarantined, pending final diagnosis (see chapter 5). The quarantined endoscope may be reused exclusively on the same patient if required. If a TSE is confirmed or cannot be excluded, the endoscope must be destroyed.

For all other types of endoscopy standard decontamination procedures should be followed and the endoscope returned to use.

C1.3: Asymptomatic patients at risk of TSE, other than vCJD

Neurological endoscopes should be single use where possible. A reusable endoscope may be quarantined, pending final diagnosis (see chapter 5). The quarantined endoscope may be reused exclusively on the same patient if required. If a TSE is confirmed or cannot be excluded, the endoscope must be destroyed.

If the risk of contamination with olfactory epithelium cannot be excluded with confidence, endoscopes entering the nasal cavity should be single use where possible. A reusable endoscope may be quarantined, pending final diagnosis (see chapter 5). The quarantined may be reused exclusively on the same patient if required. If a TSE is confirmed or cannot be excluded, the endoscope must be destroyed. In some instances it may be possible to protect the endoscope with a disposable sheath, which should then be destroyed by incineration. This feasibility of this option should be determined following discussed with the surgical team carrying out the procedure and the endoscope manufacturer.

For all other types of endoscopy standard decontamination procedures should be followed and the endoscope returned to use.

C2: vCJD

C.2.1: Symptomatic vCJD (definite or probable)

For all types of endoscopy on definite or probable cases of vCJD the endoscope must be destroyed after use. If endoscopy is required on a patient with vCJD the institution should try to source an endoscope that has been designated for use on patients with documented vCJD, if necessary from another institution.

Endoscopes used on patients with vCJD may be quarantined and designated for use only on future patients with documented vCJD. This option should only be chosen if the institution has detailed instrument tracking in place for endoscopes and a secure site for storing quarantined instruments. The quarantine procedure should follow the guidelines detailed in chapter 5. If an endoscope is quarantined and designated for use only on future patients with documented vCJD the institution should inform other institutions likely to carry out endoscopy on similar patients that a designated instrument is available. The relevant professional society (e.g. gastroenterology or otolaryngology societies) should also be informed.

C.2.2: Asymptomatic patients at risk of vCJD (see table 2.3)

Neurological endoscopes should be single use where possible. A reusable endoscope may be quarantined, pending final diagnosis (see chapter 5). The quarantined endoscope may be reused exclusively on the same patient if required. If a TSE is confirmed or cannot be excluded, the endoscope must be destroyed.

If the risk of contamination with olfactory epithelium cannot be excluded with confidence, endoscopes entering the nasal cavity should be single use where possible. A reusable endoscope may be quarantined, pending final diagnosis (see chapter 5).

The quarantined endoscope may be reused exclusively on the same patient if required. If a TSE is confirmed or cannot be excluded, the endoscope must be destroyed.

For all other types of endoscopy standard decontamination procedures should be followed and the endoscope returned to use.

C3: Minimising the risk of TSE transmission via endoscopes

Every effort should be made to avoid unnecessary procedures, including endoscopy, on patients with known or suspected TSE's. The commonest situation in which endoscopy may be considered on such patients is for placement of gastrostomy feeding tubes. Alternatives should be sought, such as ultrasound-guided tube placement. In the absence of such alternatives the guidance given below should be followed. These guidelines are adapted from the European Gastrointestinal Endoscopy Society's guidelines on endoscopy and TSE [23]:

- Traumatic intubation, during upper gastrointestinal or otolaryngological endoscopy, must be avoided to prevent damage to the mucosa overlying tonsils, adenoids or other lymphoid tissue.
- Unnecessary biopsies should be avoided.
- Multiple biopsies, taken on a single insertion of the biopsy forceps, may overload the biopsy cusp and increase the risk of contaminating the biopsy channel and should be avoided.
- Biopsy forceps should be properly maintained: damaged or inferior forceps may tear, rather than cut, the tissue being sampled and thus increase the risk of contaminating the biopsy channel of the endoscope.
- Single-use biopsy forceps should be considered, particularly for upper gastrointestinal and otolaryngological endoscopy.
- All needles used in endoscopy should be disposed of after single use.
- Cytology brushes cannot be effectively decontaminated and should be disposed of after single use.

For lower gastrointestinal endoscopy biopsy of Peyer's patches in the ileum may pose a risk, though the risk is only theoretical. Unnecessary ileal biopsies should be avoided. If ileal biopsy is required, single-use biopsy forceps should be used.

Thorough cleaning of endoscopes provides the greatest protection against potential endoscopic transmission of TSEs. It is important to note that aldehydes, such as glutaraldehyde, fix protein and must not be used to disinfect endoscopes until they have been thoroughly cleaned, washed with detergent and rinsed with water. Particular attention should be given to manual cleaning of the biopsy channel of the endoscope using a purpose-designed brush. These cleaning brushes should be disposable.

Appendix D: Routine Patient Care

TSEs are not spread from person to person through routine contact. Patients with TSEs do not put other patients, health care workers, patient relatives or other members of the community at risk of acquiring a TSE. Normal social and clinical contact, including non-invasive clinical investigations (e.g. routine radiology, ECG etc.), does not pose a risk for transmission of TSEs. Patients with TSEs should receive the same standard of care as patients with other illnesses and should not be denied admission to hospital, long-term care or other health care institution on the basis of having a TSE.

Patients with TSEs do not require protective isolation in hospital or other healthcare settings and may be nursed on an open ward. Patients with TSEs do not need to be nursed in a private room for infection control reasons, though a private room may be appropriate for compassionate reasons.

No special precautions are needed for feeding utensils, feeding tubes, suction tubes, bed linen or other items used in routine patient care. In caring for patients with vCJD feeding tubes, suction tubes and other items may come in contact with moderate infectivity tissue. As is the case for all patients, these items must be designated as single use, or for use only on a single patient.

D.1: Occupational injury

There have been no confirmed cases of occupational transmission of TSEs. However, cases of CJD have been reported in healthcare workers. Although there is no evidence that occupation was a factor in these cases it is prudent to take a precautionary approach to occupational exposure to TSEs, as recommended in the WHO guidance on TSE infection control [25]. Standard precautions should be taken for all situations where there is potential for exposure to body fluids or other potentially infectious materials, not just for contact with known or suspected TSE cases. Personnel, who work with known or suspected TSE cases, or with potentially infectious material from such cases, should be informed about the nature of the hazard and relevant safety procedures. They should be reassured that adherence to the guidelines contained in this document greatly reduce any risk associated with potential occupational exposure to TSEs.

Healthcare institutions that are likely to deal with TSE cases or potentially infectious materials from such cases should have a written protocol for minimising the risk of occupational exposure and for post-exposure management if such an exposure occurs.

D.1.1: Post-exposure management

Healthcare personnel who have had an occupational exposure to TSE-potentially infectious material should receive appropriate counselling. This counselling should include the fact that no human TSE cases are known to have occurred as a result of occupational exposure. The following strategies for dealing with occupational exposures have been adapted from WHO guidance, though it is important to note that their usefulness is untested and unknown [25]:

- **Contamination of unbroken skin with internal body fluids or tissues:** The area should be washed with detergent and copious amounts of warm water, rinsed and dried. Scrubbing of the area should be avoided. The exposure should be reported following the current guidelines for the healthcare institution.
- **Needle-stick injuries or lacerations:** The site of the injury should be gently encouraged to bleed and then washed with detergent and copious amounts of warm water, rinsed, dried and covered with a waterproof dressing. Scrubbing of the area should be avoided. Further treatment, such as suturing, should be used as appropriate to the type of injury. The injury should be reported following the current guidelines for the healthcare institution.
- **Splashes into the eye or mouth:** The affected site should be irrigated with copious amounts of normal saline (for eye splashes) or water (for mouth splashes). The exposure should be reported following the current guidelines for the healthcare institution.
- **Recording of exposure incidents:** A written record of all exposures should be prepared and kept for a minimum of 20 years.

D.2: Special situations

D.2.1: Pregnancy and childbirth

TSEs are not known to be transmissible from mother to child during pregnancy or childbirth. No special precautions are required for managing pregnancy in someone with a known or suspected TSE, unless they require an invasive procedure. Childbirth can be managed using standard infection control precautions. Although there is no known increased risk from exposure to placenta or associated material and fluids it seems prudent to take precautions to avoid exposure to these materials. They should be contained and destroyed by incineration. A TSE occurring in a woman of childbearing age is more likely to be vCJD than a TSE occurring in an older woman. Single-use instruments should be used where the diagnosis is known to be vCJD. For other TSEs reusable instruments can be re-processed according to best practice and returned to use. For home deliveries the midwife or other person in charge of the delivery should ensure that any contaminated material is contained and disposed of by incineration.

D.2.2: Anaesthesia

TSEs are not transmitted by the respiratory route. However, in the case of vCJD, there is a small risk that anaesthetic instruments/equipment contacting the mouth, pharynx, tonsils or respiratory tract may contact tissues with a moderate level of TSE infectivity. For procedures on patients with a known or suspected TSE instruments/equipment that may contact such tissues should be disposable.

In situations where a patient does not have a known or suspected TSE, or where the clinical history is unavailable (i.e. emergency situations), items that come into contact with mucous membranes, such as laryngoscope blades or bronchoscopes, should be decontaminated according to standard protocols. Particular attention should be given to ensuring that such instruments undergo thorough physical cleaning, either manual or automated cleaning, prior to decontamination. Such instruments could potentially

be used on patients who are incubating vCJD, though the risk is probably very small, and it is very unlikely that these instruments would contact moderate infectivity tissue. Nevertheless, as for gastrointestinal endoscopy, care should be taken to avoid traumatic intubation to further reduce any potential for contacting moderate infectivity tissues.

For local anaesthesia needles should not be reused (as per standard precautions). Needles contacting CSF must be discarded and destroyed.

D.2.3: Lumbar puncture

CSF is considered to be potentially infectious for TSEs, though the potential level of infectivity in TSE cases is unclear. Lumbar puncture should be avoided, if possible, on patients with a known or suspected TSE. Single-use, disposable needles should be used for lumbar puncture on all patients, regardless of TSE risk. Lumbar puncture needles, along with all contents of dressing packs used during the procedure, should be disposed of in a secure sharps container that will subsequently be destroyed by incineration.

D.2.4: Care in the community

D.2.4.1: Patients with a known or suspected TSE

The care of patients with a known or suspected TSE in the community should follow the same infection control guidance as for hospitalised patients, as outlined above. Standard infection control precautions should be used for all routine patient contact in the community.

Healthcare risk waste generated in the community from patients with known or suspected TSE, such as swabs or sharps, should be disposed of by incineration. Such waste should be placed in a secure sharps container, which should be clearly labelled as containing contaminated waste for incineration. Health professionals responsible for the care of such patients in the community should contact their local Health Board to clarify local arrangements for disposal of healthcare risk waste from the community.

Spillages of body fluids or other healthcare risk waste material should be handled as described below in section D.3. Used or soiled bed linen does not require special precautions and should be washed and dried according to standard methods.

D.2.4.2: Invasive procedures in the community

Invasive therapeutic procedures on patients with a known or suspected TSE should be avoided in the community where possible. If invasive procedures are required these should be carried out in a hospital, or other healthcare institution, that has ready access to waste disposal and decontamination facilities. Unnecessary diagnostic procedures, such as phlebotomy, should also be avoided.

Some invasive procedures may be carried out in the community that involve contact with moderate-infectivity tissues. The same precautions should be taken as for similar procedures in hospital or dental settings (see section 3.2.2 and appendix B).

Practitioners carrying out such procedures should ensure that they have access to decontamination facilities that can reprocess reusable instruments according to best practice. Otherwise single-use instruments should be used.

Most minor surgical procedures carried out in the community, such as dermatological procedures and skin surgery, can be classed as low risk for TSE transmission. Routine decontamination procedures may be used. Individual practitioners should review their decontamination facilities and protocols to ensure that they meet accepted standards.

D.2.5: Alternative and complementary therapies

Any instruments that puncture the skin, such as needles or acupuncture studs, should be designated for single use and should not be reprocessed. Such single use instruments should be disposed of in secure sharps containers that are subsequently destroyed by incineration. Standard precautions should be followed for all procedures that involve skin puncture or possible contact with body fluids.

D.3: Healthcare risk waste

Body fluids (blood, urine, faeces etc.) from patients with TSEs should be handled and disposed of using the same precautions as for any other patient.

“TSE infectious waste” is defined as high or moderate infectivity tissues from patients with a known or suspected TSE or high infectivity tissue from a patient at increased risk of developing a TSE and any disposable items that have come in contact with any of these tissues [25]. All such materials should be placed in secure, leak-proof containers and disposed of by incineration at an authorised incineration site. Waste containers should be rigid, spill-proof boxes with sealable lids that comply with UN/ADR test standards. Containers should only be filled to three-quarters full and should have a cable tie, bar code or other marking to indicate the hospital, ward/centre and date of filling. Containers should be labelled with a UN number [UN 3291], diamond-shaped risk label with Class number [6,2] and a biohazard symbol.

Institutions where TSE-risk waste material is likely to be generated should have a written waste disposal policy, which should include detailed procedures for disposing of TSE infectious waste.

When working with infectious specimens enamel, heat-stable plastic or disposable trays should be used to minimise the risk of contamination. Re-usable trays may be decontaminated using one of the methods described in section 4.2. Disposable items should be incinerated after use. Spills of potentially TSE infectious materials should be removed using absorbent materials, which should then be contained and incinerated. The surface on which the spill occurred should be decontaminated using the method described in section 4.2.3. Disposable gloves and an apron should be worn when removing such spills and these should also be contained and incinerated after use.

Appendix E: Laboratory safety

E.1: Safety in the healthcare laboratory

Routine diagnostic laboratory work should not expose laboratory workers to an increased risk of acquiring a TSE, assuming that standard laboratory safety precautions are followed. Adherence to routine precautions in the laboratory will reduce the risk of infection.

Laboratories should have written safety protocols. Only persons who have been advised of the potential hazards and who meet specific entry requirements (i.e. training) should be allowed to enter the laboratory working areas, or to participate in the collection of high infectivity tissues from patients with confirmed or suspected TSEs.

It should be noted that these guidelines only refer to routine diagnostic laboratories. Research laboratories planning to carry out work on TSE infectious materials should seek specialist advice. WHO has identified a number of reference laboratories that may be contacted for advice on safety protocols for research laboratories.

E.2: Clinical diagnostic laboratories

Most diagnostic examinations in clinical laboratories are performed on blood (e.g. complete blood counts) and serum (e.g. chemistries), usually with automated analysing equipment. No special precautions, other than standard precautions, are needed for handling blood or blood components in clinical laboratories. Other body fluids, secretions and excretions, with the exception of CSF, contain no infectivity, and need no special handling.

CSF from patients with known or suspected TSE may be infectious and must be handled with care. It is recommended that analysis not be performed in automated equipment, and any materials coming in contact with the CSF from a patient with a known or suspected TSE must either be incinerated or decontaminated according to one of the methods listed in section 4.2. There is no reason for a diagnostic test to be denied if these measures are observed.

E.3: Surgical pathology

Although brain biopsy tissue is probably the most likely tissue from a patient with a TSE to be examined in the surgical pathology laboratory, other tissues may be sent to the laboratory for examination.

E.3.1: Precautions for handling high and moderate infectivity tissue samples from known or suspected TSE cases

- Whenever possible and where available, specimens should be examined in a laboratory or centre accustomed to handling high and moderate infectivity

tissues; in particular, high infectivity tissue specimens should be examined by experienced personnel in a TSE laboratory.

- Samples should be labelled 'Biohazard'.
- Single-use protective clothing is preferred as follows:
 - liquid repellent gowns over plastic apron;
 - gloves (cut-resistant gloves are preferred for brain cutting);
 - mask;
 - visor or goggles.
- Use disposable equipment wherever possible.
- All disposable instruments that have been in contact with high and moderate infectivity tissues should be clearly identified and disposed of by incineration.
- Use disposable non-permeable material to prevent contamination of the work surface. This covering and all washings, waste material and protective clothing should be destroyed and disposed of by incineration.
- Fixatives and waste fluids must be decontaminated by a decontamination method described in section 4.2 or adsorbed onto materials such as sawdust and disposed of by incineration as a hazardous material.
- Laboratories handling large numbers of samples are advised to adopt more stringent measures because of the possibility of increased residual contamination, e.g. restricted access laboratory facilities, the use of 'dedicated' microtomes and processing labware, decontamination of all wastes before transport out of the facility for incineration.

E.3.2: Histopathological examination of high-infectivity tissues from known or suspected TSE cases, including post-mortem specimens

Only persons who have been advised of the potential hazards and trained in the specific methods used for TSE infectious tissues should be permitted to work in laboratories where high infectivity tissues are being processed. Facilities conducting a large number of histological examinations on high infectivity tissues should dedicate laboratory space, processors, instruments, glassware and reagents for this purpose. Specimens should be handled under Biosafety Containment Level 3. A lower level of containment may be acceptable in some circumstances, depending on local risk assessment.

It is important to note that formalin and glutaraldehyde-fixed TSE tissue retains infectivity for long periods, if not indefinitely. As a result, they should be handled with the same precautions as fresh material and be considered infectious throughout the entire procedure of fixation, embedding, sectioning, staining, and mounting on slides, until or unless treated with formic acid. Although exact procedures may vary, formic acid treatment consists of placing small pieces of fixed tissue, no more than 4 to 5 mm thick, in 50 to 100 ml of 95% formic acid for an hour, and then transferring them to fresh formalin for another two days before further processing. The entire procedure should be conducted using continuous, gentle agitation.

All of the serial steps involved in bringing the blocks from formalin into paraffin and, after sectioning, bringing the mounted paraffin sections back into aqueous staining solutions, can be carried out manually, or in an automatic processor dedicated to TSE tissues. It is also advisable to dedicate a microtome for sectioning non-formic acid treated tissue blocks, as there is no practical way to disinfect the instrument. Formic acid treated sections can be cut on a standard microtome (if possible, using a disposable knife or dedicated blade) and processed as usual. Processing fluid should be decontaminated and debris (such as wax shavings) from section cutting should be contained and disposed of by incineration. Formic acid treated sections tend to be brittle, but show good preservation of histologic morphology.

Slides made from sections, which have been treated with formic acid, can be considered non-infectious. Slides made from sections that have not been treated with formic acid may also be handled without specific precautions, once the cover slip is sealed to the slide and chemically disinfected to ensure external sterility, but should be labelled as a hazardous material. These slides, if damaged, should be treated using a method described in section 4.2, and destroyed.

Containers used for the storage of formalin-fixed tissues should, after secure closing, be cleaned using a method in section 4.2, marked “Hazardous”, and stored separately (e.g., in sealed plastic bags). When tissue is needed, the container can be removed from the bag, set upon a water-resistant disposable mat, and manipulation of the tissue confined to the mat. After the tissue is replaced, the area and container are cleaned according to methods described in 4.2.3, and the container put into a new plastic bag for further storage.

Electron microscopic examination of tissue sections is not indicated for diagnostic purposes, and is not recommended except as an investigational research tool. Preparation of specimens for electron microscopy should be performed with the same precautions as for histopathology. Electron microscopy of tissue sections poses negligible risk both to the microscope and the operator due to the very small amount of tissue deposited on a grid. Handling requires no special precautions except for disposal of such grids as infectious waste through incineration [25].

E.4: Transport of specimens by air

The transportation of pathology samples by air must comply with the International Air Transport Association (IATA) Restricted Articles Regulations and any additional requirements of the individual carriers. Documentation required by the IATA includes Shipper’s Certificate for Restricted Articles, which requires that the content, nature and quantity of infectious material to be disclosed. The WHO Guidelines for the Safe Transport of Infectious Substances and Diagnostic Specimens¹ provides additional information on the safe transport of material. Where properly packaged according to these guidelines, there is no danger to the carriers.

Appendix F: After Death

The following recommendations have been adapted from the WHO Infection Control Guidelines for TSEs and the UK ACDP guidelines on TSE infection control.

F.1: Precautions for handling of the deceased patient

On the death of a patient with confirmed or suspected TSE, the removal of the body from the ward, community setting, or hospice, should be carried out using normal infection control measures. There is little or no risk of acquiring a TSE from routine contact or handling of the deceased. Nevertheless it is recommended that the deceased patient be placed in a sealed body bag prior to moving, in line with normal procedures for bodies where there is a known infection risk. Where the skull is open or there is CSF leakage, and where sutures do not completely control this leaking, the bag should be lined with materials to absorb any fluid, and the body should be moved in a sealed body bag.

F.2: Post mortem examination

Post mortem examinations remain an essential element in confirming the clinical diagnosis and the cause of death as TSE. Post mortem examinations do, however, potentially expose pathologists and mortuary staff to infectious materials.

Ideally, three people should be present during the examination: the pathologist assisted by one technician, and one further person to handle and label specimen containers. Except for training purposes, observers should be prohibited or kept to a minimum. All personnel should be made aware of the relevant history of the patient and fully informed of procedures for such post mortem examinations.

Disposable protective clothing should be worn, including surgical cap and gown, apron, double gloves, and a face visor that completely encloses the operator's head to protect the eyes, nose and mouth. Consideration should be given to the use of hand protection, such as armoured or cut-resistant gloves.

Disposable or dedicated reusable instruments are recommended in order to minimise the risk of environmental contamination. Manual saws are recommended in order to avoid the creation of tissue particulates and aerosols and for ease of decontamination after use. Electric saws, if used, should be operated inside an aerosol-containing bag unless ventilated helmets with an appropriate filter are worn. Instruments and mortuary working surfaces should be decontaminated following the guidance in section 4.2.

Restricted post mortem examinations on TSE cases can be undertaken in any mortuary. If examination is limited to the brain, a plastic sheet with absorbent

wadding and raised edges should be first placed underneath the head to ensure containment of tissue debris and body fluids (e.g., CSF). The scalp should be reflected in the normal way and the cranium opened. After removal of the brain, replacement of the skullcap and suturing of the skin, the plastic sheet containing all tissue debris and drainage should be bagged and sealed and sent for incineration. A full post mortem examination is discouraged except in dedicated facilities, unless special circumstances warrant the added difficulty of infectivity containment.

F.3: International transport of bodies

If there is a need to transport the deceased patient internationally, it will be necessary to comply with the International Civil Aviation Organization (ICAO), International Air Transport Association (IATA) Restricted Articles Regulations, and any additional requirements of the individual carriers. It should be noted that the IATA Regulations require the embalming of the body.

F.4: Undertakers and embalmers

Mortuary procedures may be performed on the bodies of patients who have died from a TSE with a minimum of inconvenience, while ensuring the safety of personnel and avoiding contamination of the workplace. Transportation of the unembalmed body to the mortuary should be in a sealable, impermeable plastic pouch. Ordinary contact or handling of an intact, unautopsied body does not pose a risk, and cosmetic work may be undertaken without any special precautions. If the body has undergone autopsy, care should be taken to limit contamination of the workplace by any leaking bodily fluids (especially from the cranium) when transferring the body from its transport bag to the mortuary table that has been covered with an impermeable sheet. No other precautions are required, except for embalming.

F.4.1: Embalming

An intact (unautopsied) body can be safely managed with only minor adjustments to the usual procedures. The body should be placed on an impermeable sheet or body pouch to avoid surface contamination from perfusion drain sites, and all drainage fluids should be collected into a stainless steel container. Perfusion sites should be closed with cyanoacrylates (super glue).

Embalming an autopsied or traumatized body is not encouraged, but may be safely performed when the following precautions are observed. Disposable masks, gowns, and gloves should be worn, just as is done by pathologists performing an autopsy. The body should be placed on an impermeable sheet or body pouch so that suture site leakage can be contained, and perfusion drain sites should be similarly arranged to avoid surface contamination. All drainage fluids should be collected into a stainless steel container. Perfusion and autopsy incision sites should be closed with cyanoacrylates (super glue).

At the conclusion of the perfusion procedure, the container of drainage fluids should be decontaminated by adding sodium hydroxide pellets at the rate of 40g per litre of fluid. The mixture should be stirred after a few minutes and care should be taken to avoid spillage, as the fluid will be hot. It should then be left undisturbed for at least one hour, after which it can be disposed of as for any other mortuary waste. Plastic

sheets and other disposable items that have come into contact with bodily fluids should be incinerated. Mortuary working surfaces that have accidentally become contaminated should be flooded with sodium hydroxide or bleach, left undisturbed for at least one hour, then (using gloves) mopped up with absorbent disposable rags, and the surface swabbed with water sufficient to remove any residual disinfectant solution.

Non-disposable instruments and tools should be decontaminated using one of the methods recommended in section 4.2. At the conclusion of the decontamination procedure, the instruments should be washed with water to remove residual disinfectant fluid before drying and re-use. Sodium hydroxide or bleach can be disposed of as uninfected (but corrosive) waste fluid.

F.5: Funerals and cremations

Relatives of the deceased may wish to view or have some final contact with the deceased. Superficial contact, such as touching or kissing the face, should not be discouraged, even if an autopsy has been conducted. The body bag may be rolled down temporarily to allow such contact.

No special precautions are required for burial or cremation of a patient with a known or suspected TSE, including vCJD. Interment in closed coffins does not present any significant risk of environmental contamination, and cremated remains can be considered to be sterile, as the infectious agents do not survive incineration-range temperatures (1000°C) [25].

F.6: Exhumations

If exhumation is required the body should be considered as having the same infectivity as at the time of burial and the precautions used for an autopsy should be followed.

F.7: Body donation for teaching purposes

Anatomy departments should not accept, for teaching or research purposes, any body or organs from persons confirmed, suspected, or at high risk for TSE, unless they have specific training or research programs for TSEs, including access to specialized equipment, procedures, appropriate containment facilities and training for managing TSE contaminated tissues. Departments should make inquiries of those responsible for donating the body, and of the medical staff involved in the care of the donor, to ensure the rigorous adherence to this recommendation.

Appendix G: Management of Possible Exposure to TSEs via Medical Devices

Even with the full implementation of the guidelines contained in this document it is still possible that patients may be exposed to medical devices that previously contacted high or moderate risk tissue in a patient subsequently diagnosed as having a TSE. Instruments may be used for procedures that involve contact with such tissues on patients who have no evidence of a TSE at the time of the procedure but who subsequently become symptomatic. If the guidelines on decontamination of medical devices have been followed the risk of transmission of a TSE in such cases is negligible. Nevertheless such incidents will need to be thoroughly investigated and documented. Patients on whom the implicated devices were subsequently used may have to be contacted and receive counselling, depending on the individual incident.

The management of such incidents is not directly addressed in the various current international guidelines on TSE infection control. However the UK Department of Health has set up a CJD Incidents Panel to address this issue. This panel produced a discussion document in October 2001, on which the following recommendations are largely based [7].

A similar critical incidents panel should be established in Ireland.

G.1: Investigation of possible exposure incidents

G.1.1: Incident management team

The local infection control committee should be responsible for coordinating the investigation of possible exposure incidents and should appoint an incident management team. This team should include the following personnel:

- Consultant microbiologist
- Infection control nurse
- CSSD manager
- Manager of theatre/unit where source procedure was carried out
- Senior clinician with responsibility for source patient/procedure
- Hospital/institution CEO
- Press officer/spokesperson
- Local Director of Public Health or specialist in public health medicine

Other personnel may be required on the incident management team, depending on the nature of the incident. Expert advice and/or representation on the incident management team may be sought from the National CJD Advisory Committee, NDSC, DOHC or other relevant bodies.

The following should be informed of the incident at the outset of investigation:

- Hospital/institution administration
- Local Public Health Department
- National CJD Advisory Committee

G.1.2: Initial investigations

The incident management team should thoroughly review the source procedure, documenting instruments used, personnel involved, decontamination procedures etc. They should also document the diagnosis in the source patient, noting in particular whether this is a confirmed or suspected TSE case and the type of TSE diagnosed.

Based on these initial investigations the team should then decide whether or not a full look-back investigation, with documentation of all potentially exposed patients, is required

G.1.3: Documentation of potentially exposed patients

The names and contact details of patients who were potentially exposed to instruments used during the source procedure should be entered into a secure, confidential database.

The likely risk of TSE exposure for each patient in the database should be determined based on the following criteria:

- Likelihood that they were exposed to instruments used during the source procedure
- Likelihood that those instruments contacted high or moderate risk tissues during the source procedure
- Likelihood that those instruments contacted high or moderate risk tissues during the procedure carried out on the potentially exposed patient
- The number of times the instruments were reprocessed between the source procedure and the potential exposure
- The nature of the instrument reprocessing, particularly noting whether or not the instruments were reprocessed using a TSE-inactivating procedure
- The nature of the TSE diagnosis in the source patient (e.g. sporadic CJD or vCJD)

G.1.4: Informing potentially exposed individuals about their exposure

The UK CJD Incidents Panel recommends that most people listed in the confidential database, described above, would not be informed about their potential exposure. This is based on the uncertain incubation period, the lack of a reliable diagnostic test for persons incubating a TSE, the lack of treatment options and the low risk of transmission from persons who may be incubating a TSE. In addition for most people exposed the risk of TSE transmission is likely to be remote. Thus there is no medical benefit from informing most people with a potential exposure. On the other hand informing someone of potential exposure is likely to result in significant psychological harm.

It is proposed that individuals who wish to know if their names are on the database should be given that choice, after appropriate counselling.

There may be a small number of exposed patients who will need to be informed of their exposure, where there is a sufficient risk to warrant public health action. This may be in the setting of a very high-risk procedure or where there has been a breach in decontamination protocols. Based on the risk modelling included in the UK CJD Incidents Panel's report this will only include the first 2-6 patients exposed to the implicated instruments, as the risk of transmission following repeated instrument decontamination is negligible. Such patients may need to be informed of their exposure and advised not to donate blood or organs and to inform their doctor if they are to undergo any invasive procedure in the future.

Appendix H: Membership of CJD Infection Control Subcommittee

Dr Robert Cunney (chair)	Clinical Microbiologist National Disease Surveillance Centre, Dublin
Mr. Rory McConn-Walsh	Consultant Otolaryngologist Beaumont Hospital, Dublin
Prof. Hilary Humphreys	Consultant Microbiologist Royal College of Surgeons in Ireland and Beaumont Hospital, Dublin
Ms. Margaret Nadin	Infection Control Nursing Officer Beaumont Hospital, Dublin
Ms. Helen Cleary	Neurosurgical Theatre Sister Beaumont Hospital, Dublin
Ms. Oonagh Ryan	CSSD Manager Beaumont Hospital, Dublin
Dr Stephen Flint	Consultant in Oral Medicine School of Dental Science University of Dublin, Trinity College
Dr Joan O'Riordan	Consultant Haematologist Irish Blood Transfusion Service, Dublin
Dr Darina O'Flanagan	Director National Disease Surveillance Centre, Dublin
Ms. Beryl-Ann Waldron	Laboratory Technologist Beaumont Hospital, Dublin
Dr Nick Breen	General Practitioner Greystones, Co. Wicklow
Ms. Michelle Tait	CSSD Manager School of Dental Science University of Dublin, Trinity College
Mr. Christopher Pidgeon	Consultant Neurosurgeon Beaumont Hospital, Dublin

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Glossary

- *Autosomal dominant*: Requires only one affected parent have the trait to pass it to offspring.
- *Bovine spongiform encephalopathy (BSE)*: A prion disease of cattle, first reported in 1986 in Great Britain, characterised clinically by apprehensive behaviour, hyperesthesia, and ataxia and histopathologically by spongiform changes in the grey-matter neuropil of the brain stem.
- *Central sterile services department (CSSD)*: The hospital department responsible for supplying sterile items to wards, clinical units and operating theatres and for cleaning and reprocessing reusable surgical instruments.
- *Creutzfeldt-Jakob disease (CJD)*: A human prion disease that typically affects people over the age of 50 with an annual incidence of approximately 1/1,000,000 population. Infection results in dementia, myoclonus, ataxia and other neurologic symptoms. The disease progresses rapidly to coma and death after a 3 to 12 month illness.
- *Disinfection*: A cleaning process that destroys of most microorganism, but not highly resistant forms such as bacterial and mycotic spores.
- *Dura mater*: The outermost, toughest and most fibrous of the three membranes (meninges) covering the brain and spinal cord.
- *Fatal familial insomnia (FFI)*: A familial spongiform encephalopathy characterised by amyloid plaques in the thalamus. The mean age of onset is 50 and progressive insomnia, with psychiatric disturbance, is followed by dementia and death.
- *Gerstmann Straussler Scheinker syndrome (GSS)*: A familial spongiform encephalopathy. Compared to classical CJD there is slower progression, signs of spinocerebellar ataxia, and the spongiform changes are less pronounced.
- *High-infectivity tissues*: Human tissues that could contain a high level of prion infectivity ($>10^7$ ID₅₀/g) in cases of TSE: brain, spinal cord, crainial/spinal ganglia, dura mater, optic nerve, and retina.
- *Human pituitary-derived hormones*: Hormones, usually human growth hormone or gonadotrophin, extracted from human pituitary glands removed at autopsy.
- *Iatrogenic*: Induced inadvertently by medical treatment or procedures or activity of a health professional.
- *ID₅₀*: The infectious dose of an organism that is likely to cause disease in 50% of recipients.
- *Invasive procedure*: Any medical or surgical procedure involving puncture or incision of the skin or insertion of an instrument or foreign material into the body.
- *Kuru*: Spongiform encephalopathy found in members of the Fore tribe of New Guinea, probably transmitted by funeral rites that involved ritual cannibalism.
- *Low-infectivity tissues*: Human tissues with undetectable or very low levels of prion infectivity ($<10^4$ ID₅₀/g) in cases of TSE.
- *Lymphoreticular system*: The tissues and organs (including the bone marrow, spleen, thymus and lymph nodes) that produce and store cells that fight infection and the network of vessels that carry lymph.

- *Medical device*: A piece of medical equipment or an instrument that may come in contact with human tissues.
- *Moderate-infectivity tissues*: Human tissues that could contain a moderate level of prion infectivity (10^4 - 10^7 ID₅₀/g) in cases of vCJD: ocular tissue (other than optic nerve and retina), tonsil, spleen and other lymphoreticular tissues. Ocular tissues, other than optic nerve and retina, may also contain moderate levels of infectivity in cases of CJD and other TSEs other than cCJD.
- *Prion related protein (PrP)*: A normal protein anchored to the outer surface of neurons and, to a lesser extent, the surfaces of other cells, including lymphocytes.
- *Prion*: A proteinaceous infectious agent, which is an altered form of a naturally occurring protein (prion related protein).
- *Scrapie*: A chronic neurological disease of sheep and goats, similar to other spongiform encephalopathies and much used as a model for studying such diseases.
- *Sterilisation*: The complete destruction or elimination of all living microorganisms, accomplished by physical methods, chemical agents or radiation.
- *Surgical instruments*: Hand-held tools or implements used by health professionals for the performance of surgical tasks.
- *Transmissible spongiform encephalopathy (TSE)*: One of a group of diseases characterised by long incubation and fatal progressive course with characteristic spongiform degeneration of grey matter of the cortex.
- *Standard precautions*: Prudent standard preventive measures to be taken by professional and other health personnel during patient contact to avoid contracting a communicable disease; particularly relevant to prevention of transmission of blood-borne viruses.
- *Variant Creutzfeldt-Jakob disease (vCJD)*: A human prion disease that is thought to be due to the same prion protein responsible for bovine spongiform encephalopathy. Compared to classical CJD the age of onset tends to be younger, the duration of illness is longer and patients have more neuro-psychiatric symptoms

