GUIDELINES FOR INFECTION CONTROL IN THE CLINICAL NEUROPHYSIOLOGY DEPARTMENT

Foreword

These guidelines are based upon relevant publications submitted by member organisations of OSET and complemented by additional material from the Infection Control Manual of Queens Medical Centre, Nottingham England. Any regulations or guidelines that define infection control requirements in member countries can be found in their specific references.

The aim of this document is to produce international infection control guidelines for use throughout all of the member countries of OSET. Depending on local conditions, therefore, these may be seen as either minimum standards of practice or standards to work towards.
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Introduction

All those in direct contact with patients have a responsibility in ensuring that transfer of infection is kept to a minimum. This includes patient-to-patient, patient-to-staff, and staff-to-patient transfer. The Guidelines are designed to assist neurophysiology staff in achieving that aim. The Guidelines include: general recommendations; standard precautions for routine procedures; additional recommendations for specific procedures or investigations on patients in high risk groups, i.e. human immunodeficiency virus (HIV), hepatitis B, and Creutzfeldt-Jakob disease (CJD) and recommendations for use in the operating theatre environment.

1. GENERAL RECOMMENDATIONS

1.1. Strategy/Documentation

All clinical neurophysiology departments should have an infection control strategy that is planned, implemented, monitored, and updated to ensure that it is functioning in accordance with the current state of knowledge. Infection control practices for staff should be documented. The requirements of local regulations need to be taken into consideration in drawing up the code and departmental practices should be drawn up in consultation with the local infection control team. The documentation should form part of an induction process and on-going training should be provided to staff to enable them to understand and adopt the requirements detailed.

1.2. Inventories/Registers

If a department is a significant user of chemical substances, a listing of all substances, including those used for infection control, should be available. This should include up-to-date material and safety data sheets.

1.3. Transmission of Infection

Infections can be transmitted by any of three routes:

1.3.1. Direct contact;

1.3.2. Indirect contact---a common vehicle (food, water and blood), or a vector (mosquito, flea, tick, mite, or louse); and

1.3.3. Airborne---droplet or dust.

The major concern in clinical neurophysiology is to prevent contact and airborne transmission of infection. Contact infection may occur from inadequate cleaning of electrodes and equipment. Airborne transmission may be caused by inadequate room cleaning, a poor ventilation system, inappropriate handling of patients, and staff members who cough and sneeze.

1.4. Patients at Risk

All patients seen as out-patients or on the wards are at risk of hospital-acquired infection. Certain patient groups, or those cared for in specialised areas, may be at increased risk. These include neonates and those who may be immunocompromised by disease or drug therapy.

Similarly, patients in high dependency units (HDU), e.g., special care baby units, intensive therapy units, etc., are vulnerable because of the severity of their illness and the requirement for multiple invasive procedures and monitoring. Recognition of these factors is an essential pre-requisite in minimising infection transmission.

1.5. Communications

Communication is critical in reinforcing infection control practices. It is important that patient care staff notify other staff about potential or actual infection risk situations. The process should be covered by a previously agreed protocol.

1.6. Hand Washing

This is the single most important factor in reducing the spread of infection but it is regrettably often overlooked. Staff members need to wash hands with plain soap before and after routine contact with patients. They should use anti-microbial soap before and after contact with patients from intensive care units, isolation areas, and before and after entering surgical areas.

1.7. Occupational Health Facilities and Immunisation

If available, this service should promote, maintain, monitor, and improve the physical and mental well-being of all staff, and provide advice on minimising the risk from physical or environmental health hazards. This is achieved through health screening, vaccinations, and counselling, as may be necessary (such as following needle stick injury). All staff should be regularly tested for tuberculosis and, in certain circumstances, immunised against other infectious diseases (e.g., hepatitis B).

1.8. Monitoring Program

Systems should be in place to monitor the infection control strategy and practices used within the department. This includes the monitoring of staff compliance with the infection control practices, as well as monitoring of the sterilisation process.

1.9. Level of Precautions

Standard precautions, and sometimes additional precautions, should be applied appropriately. It is acknowledged that all blood and body substances (except perspiration) are potentially infectious for bloodborne pathogens and therefore constitute a risk. It is also a fact that anyone can harbour bloodborne infections, or any other infection, whether symptomatic or not. Every patient and every staff member, therefore, is a potential risk for cross infection (patient to staff, or staff to patient.) Any breach of the epidermis, even as slight as that caused by rubbing to lower electrode resistance, predisposes the skin to leakage of tissue fluid that may be contaminated, and thus provide a medium for cross infection.

The recommendations that follow take a consistent approach to dealing with all of these risks excepting the additional precautions made separately for the high risk groups including Creutzfeldt-Jakob disease (CJD), Gerstmann-Straussler-Scheinker (GSS), human immunodeficiency virus (HIV), and acquired immune deficiency syndrome (AIDS). There are also specific recommendations dealing with methycillin resistant staphylococcus aureas (MRSA) and botulinum toxin.

1.10. Standard Precautions

Standard precautions (as defined by NHMRC 1996 Infection Control in the Health Care Setting) are work practices required for the basic level of infection control. They include good hygiene practices, particularly: washing and drying hands before and after patient contact; the use of protective barriers, which may include gloves, gowns, plastic aprons, masks, eye shields or goggles; appropriate handling of sharps and other contaminated or infectious waste; and the use of aseptic techniques.

Standard precautions are recommended for the treatment and care of all patients, regardless of their perceived infectious status, and in the handling of:

1.10.1. Blood (also dried blood);

1.10.2. All other body fluids, secretions and excretions (excluding sweat), regardless of whether they contain visible blood;
1.10.3. Non-intact skin; and
1.10.4. Mucous membranes.

1.11. Additional Precautions

Additional precautions (as defined by NHMRC 1996 Infection Control in the Health Care Setting) are used for patients known or suspected to be infected or colonised with epidemiologically important or highly transmissible pathogens that can cause infection,
1.11.1. By airborne transmission (e.g., mycobacterium tuberculosis, measles virus, chickenpox virus),
1.11.2. By droplet transmission (e.g., mumps, rubella, pertussis, influenza,
1.11.3. By direct or indirect contact with dry skin (e.g., colonisation with MRSA), or with contaminated surfaces; and
1.11.4. By any combination of these routes.
Additional precautions are designed to interrupt transmission of infection by these routes and should be used in addition to the standard precautions (above) when transmission of infection might not be contained by using standard precautions alone.

2.STANDARD PRECAUTIONS AND ROUTINE PROCEDURES

2.1. Hand Washing

Using soap and hot water with thorough drying is recommended before handling any patient. Cuts and abrasions should be covered with a waterproof plaster. Disposable gloves should be worn if there are areas of skin breaches on the patient, or on the hands of the technologist, which are vulnerable to the transmission of infection (e.g., open sores or eczema). The requirement to wash and dry hands applies to all patient care regardless of whether gloves are worn.

2.2. Appropriate Use of Gloves

2.2.1. Gloves must be worn when anticipating contact with blood or body fluids or intact mucous membranes such as EMG needle application and when using scarifying needles for lowering skin impedance. (Consideration should be given to using skin abrasives rather than needles to lower skin impedance.)

2.2.2. Ideally, gloves should be worn during head measurement and electrode application and a new pair used for electrode removal and cleaning the head.

2.2.3. Gloves should be changed between procedures but must be changed between patients.

2.2.4. Gloves should be removed promptly after use, before touching any environmental surfaces.

2.2.5. Gloves should not be worn while operating equipment.

2.2.5. Wash hands after removing gloves.

2.2.6. Gloves do NOT protect against needle-stick injuries.

2.3. Electrode Decontamination

For all recordings, use only electrodes decontaminated to the standards recommended in these Guidelines. Strict adherence to this principle will make the chances very small for any cross-infection caused by clinical neurophysiology procedures.

2.4. Skin Preparation for Electrode Application

The safest procedure is to use a specially formulated compound to lower skin impedance as this is unlikely to cause bleeding. EEG electrodes should be attached to the patient with an adhesive electrolyte paste. The use of skin scarification with sterilised blunt needles is strongly discouraged and should be used only in exceptional circumstances.

For needle examination, or the use of subdermal clip electrodes, the site should be scrubbed with an antimicrobial solution such as alcohol povidone iodine 10%, 70% isopropyl alcohol, or alcohol chlorhexidine 0.5%. It must be applied with friction in a circular motion for a minimum of 30 seconds starting at the intended site and working outward. The solution must be allowed to air dry before electrode insertion.

2.5. Routine Procedures after Use

2.5.1. *Pad electrodes*. It is recommended that felts and pads of electrodes used for stimulating and recording in EMG, EP, and EEG applications be sterilised after each use by autoclaving at 121° C for 15 minutes or 134° C for 3 minutes. Autoclaving must be preceded by thoroughly washing the electrodes. Immersion of electrodes in hypochlorite is not suitable as this dissolves the fabric pads. Departments are advised to have a sufficient number of electrodes and to take appropriate local action to ensure sterilisation. If a hospital sterilising service is not available, departments may wish to purchase a small autoclave unit, in consultation with local infection control officers. This must be suitable and capable of reaching the recommended times and temperatures.

2.5.2. *Other surface electrodes including silver/silver chloride disc electrodes.* These electrode types must be brushed in hot detergent using gloved hands to remove surface matter. Cleaning should be done under the surface of the liquid in order to avoid aerosol sprays. (Face protection should be available.). Alternatively, clean electrodes in an ultrasound bath. Following thorough surface cleaning, electrodes should be disinfected by being immersed for 10 minutes in hypochlorite with a concentration of 1,000 ppm available chlorine (0.1%). A concentration of 10,000 ppm (1%) is recommended as this will also give electrodes a good chloride layer. It is important to rinse the electrodes under a stream of running water after immersion in the disinfectant. Alternatively, and ideally, electrodes should be sterilised by autoclaving at a temperature of 121° C for 15 minutes or at 134° C for 3 minutes.

2.5.3. *Corneal/ERG electrodes*. All electrode types should be washed with detergent and water then wiped with an alcohol swab to remove any adhering film. Disinfection follows by immersion for 10 minutes in hypochlorite 1,000 ppm available chlorine (0.1%). It is important to rinse the electrodes under a stream of clear, running water after immersion.

2.5.4. *EMG needle electrodes*. Single use disposable needles are safer and less expensive than re-usable needles when the costs for sterilisation are taken into account, and should be the product of choice. Needle electrodes pose the greatest source of risk as a medium for cross infection. They need to be handled with care to avoid the possibility of a needle stick injury. Needle handling is best kept to a minimum and re-sheathing should be avoided.

Disposable needles must be held at the stem and discarded directly into a designated puncture proof and shatter proof container that should be incinerated or disposed of in accordance with hazardous waste protocols. Needle electrodes which must be re-used because of cost considerations (i.e., concentric needles) ideally should be cleaned using ultrasound for 5 minutes before being autoclaved at 121° C for 15 minutes or 134° C for 3 minutes. Needles may be placed on a flat "velcro-like" surface or a rippled silicone packing and pulp tray for transport to the autoclave unit. The electromyographer who performs the test should be responsible for the safe disposal of needles.

Needle entry sites should be covered with a plaster to limit any blood loss and spread.

2.5.5. *EEG scarifying needles*. The use of blunt tipped needles to abrade the scalp to reduce impedance is strongly discouraged. If used, the disposable, single-use variety is the product of choice. Re-usable electrodes should be flushed through with a hot detergent below the surface of the liquid---a syringe facilitates the process. They should preferably be ultrasound cleaned before autoclaving at 121° C for 15 minutes or 134° C for 3 minutes. Immersion in boiling water is not sufficient, as several infective agents can withstand this temperature

2.5.6. *Subdermal needle electrodes.* Clean to remove all organic material. Ideally these should be ultrasound cleaned for 5 minutes before being autoclaved at 121° C for 15 minutes or 134° C for 3 minutes. As previously described, needles may be placed on a flat "velcro-like" surface or a rippled silicone packing and pulp tray for transport to the autoclave unit.

2.5.7. *Sharps/needle stick injuries.* Follow local protocols for the management of such incidents. Staff members who sustain injury from a needle should *immediately* seek expert medical advice from the hospital infection control officer or occupational health department. Encourage bleeding from the injury site and wash hands with plain soap and water. Details of the incident should be logged in an accident book.

2.5.8. *Coverings.* Fresh disposable, paper roll sheets and pillow coverings should be used for each patient and disposed of appropriately. Disposable eye pads should be used once and

then discarded. The eye patch should not be transferred from one eye of the patient to the other eye.

2.5.9. *Environmental cleaning.* All surfaces should be regularly cleaned with detergent and water. For routine disinfecting of the headbox or other equipment in the vicinity of patients, use disinfectant wipes (saturated with chlorhexidine gluconate solution B.P. 2.5% v/v in industrial methylated spirit B.P. 70% v/v), or hypochlorite solution (1000 ppm, available chlorine concentration 0.1%) followed 10 minutes later by a wipe with a damp cloth. Detergent and hot water or alcohol wipes are considered to be adequate by some infection control protocols.

2.5.10. *Spills---blood or body substances.* Spill spots should be wiped immediately with a damp cloth, tissue, or paper towel. An alcohol wipe may also be used. Discard contaminated materials (tissue, paper towelling, alcohol wipe) in accordance with local procedures.

a) For small spills (up to 10 cm in diameter), disposable cleaning gloves, eyewear and a plastic apron should be worn if there is a risk of splashing. The spill should be wiped up immediately with absorbent material, e.g., paper hand towel. Place contaminated material into impervious container or plastic bag for disposal. Clean the area with warm water and detergent, using a disposable cleaning cloth. Where contact with bare skin is likely, disinfect the area by wiping with sodium hypochlorite 1000 ppm available chlorine (or other suitable disinfectant solution) and allow to dry. Discard contaminated materials in accordance with local procedures. Hands should be washed and re-usable eyewear should be cleaned and disinfected before re-use.

b) For larger spills (greater than 10 cm in diameter), the area of the spill should be covered with granular chlorine releasing agent (10,000 ppm available chlorine) or other equivalent acting granular disinfectant and leave for 3 to 10 minutes depending on formulation and labelling instructions. Use disposable (e.g., cardboard) scraper and pan to scoop up granular disinfectant and any unabsorbed blood or body substances. Place all contaminated items into impervious container or plastic bag for disposal. The area should be wiped with absorbent paper towelling to remove any remaining blood and place in container for disposal.

Contaminated materials should be discarded in accordance with local protocols. After washing hands, mop the area with warm water and detergent. Where contact with bare skin is likely, disinfect the area by wiping with sodium hypochlorite 1000 ppm available chlorine (or other suitable disinfectant solution) and allow to dry. Discard contaminated materials in accordance with local procedures. The area needs to be well ventilated, as small amounts of chlorine are likely to be released. Do not vacuum or sweep the area immediately as this can disperse contaminates into the air and other surfaces.

3. ADDITIONAL PRECAUTIONS FOR SPECIFIC PROCEDURES AND INFECTIONS

3.1. Creutzfeldt-Jakob Disease (CJD)

The standard precautions, which also apply to the prevention of bloodborne pathogens such as hepatitis B and HIV, should be applied to the management of patients with known or suspected CJD. A genetic form of the disease, the Gerstmann-Straussler-Scheinker syndrome (GSS), has also been recognised and should be dealt with similar to CJD. It is recommended that blood and cerebrospinal fluid be considered as potential sources of infection. Electrodes used invasively and especially those exposed to the brain or spinal fluid should be destroyed.

3.1.1. *Disposable gloves* should be worn for all procedures.

3.1.2. *Pad electrodes and EMG felts* should be autoclaved at 134° C for 18 minutes or 6 cycles of 3 minutes each.

3.1.3. *Surface electrode discs* should be washed carefully, as previously described, to reduce the amount of particulate material. They should then sterilised by autoclave at 134° C for 18 minutes or 6 cycles separate 3 minutes cycles, or a hypochlorite concentration of 25,000 ppm available chlorine for 1 hour may be used.

3.1.4. *Disposable disc electrodes* are available for use in these circumstances.

3.1.5. *Needle electrodes* must be of the disposable kind and extreme care has to be exercised in disposing of them. The needles should be dropped directly into a container designed for incineration or disposed of in accordance with hazardous waste protocols.

3.1.6. *Scarifying needles* are strongly discouraged. If used they should be disposed of appropriately.

3.1.7. *Corneal contact electrodes* should be disposable and destroyed after a single use.

3.1.8. *Any other materials* sent for disposal should be enclosed within infectious waste bags labelled with the international biohazard symbol.

Neurodiagnostic equipment and other related instruments should be wiped with detergent and water or 70--90% ethyl alcohol. If the machine is contaminated with secretions or blood, follow the documented procedure for Spills---blood or body substances. (Section 2.5.10. of this document.)

3.2. Viral Hepatitis and AIDS

The major precaution in dealing with patients with viral hepatitis or AIDS is to prevent contamination from infected blood or bloody body fluids. If there is no contamination from blood, routine protocols as described are adequate. All patients should be treated as potentially infective when dealing with blood or body fluids.

Should contact occur with the potential for contamination: seek expert medical advice immediately and follow local procedures

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3.2.1. *Accidental needle stick or lacerations.* Wash wound immediately with copious amounts of warm water and report the incident according to established procedures.
3.2.2. *Of unbroken skin.* Wash skin using detergent and copious amounts of warm water, avoid vigorous scrubbing or abrasive cleansers and report according to established procedures.
3.2.3. *Splashes into the eye of blood or CSF.* Institute normal eye washing procedures using warm water and report immediately according to procedures.

3.3. Multi-resistant Staphylococcus Aureus (MRSA)

Recording personnel should be aware that handling a patient with MRSA makes their own hands the most likely route of transmission. Clothing coming into contact with an infected patient may become contaminated, especially if damp. For these reasons it is necessary to wear a fluid resistant disposable apron and gloves. Hands should be washed with an antimicrobial solution before and after contact with the patient.
Advice from infection control staff should be obtained concerning the necessity of disinfecting the headbox or recording instrument. These may be wiped with detergent and water or 70--90% ethyl alcohol.

3.4. Botulinum Toxin

Spillage of botulinum toxin should be inactivated with hypochlorite solution (10,000 ppm available chlorine, 1%), wiped using a paper towel, and disposed of appropriately. Residual toxin in a vial or syringe should be inactivated with hypochlorite and disposed of safely.

RECOMMENDATIONS FOR RECORDING IN THE OPERATING THEATRE

Staff need to be aware of their responsibility in maintaining a relatively sterile environment, and that they need to follow local policies and procedures that reduce the risk of infection to patients. Operating theatres are usually designed so that they are isolated from mainstream traffic and divided into two main areas, semi-restricted and restricted.

For semi-restricted areas follow local policies. In the absence of these, electrodiagnostic equipment can be wiped with a low level disinfectant before taking it into semi-restricted areas. The entire instrument, including cables, electrode head-box and other ancillary equipment must be wiped thoroughly.

Electrodes must be appropriately decontaminated before re-use. If electrodes or other equipment has come into contact with body fluids or infectious material during surgery, appropriate decontamination or disposal is required.

REFERENCE MATERIAL SUBMITTED BY OSET MEMBER ORGANISATIONS

Australia

Report of the Committee on Infectious Diseases
Infection Control Regulations, NAMRS
Creutzfeldt-Jacob disease and other human transmissible spongiform encephalopathies, Guidelines on patient management and infection control, NHMRC Series on Infection Control, December 1995
Infection Control in the Health Care Setting, NHMRC, April 1996

Canada

The College of Physicians and Surgeons of Ontario - Infection Control Guidelines for Facilities Performing Electrophysiologic Studies, March 1996.

France

Sterilisation of Electrodes and Control of Infection, by Danielle Canonne

United Kingdom---The Electrophysiological Technologists' Association (EPTA)

Minimising risk from transmissible diseases in clinical neurophysiology procedures---Guidelines for preventing transmission of infective agents and toxic substances by clinical neurophysiology procedures; an update. *J. Electrophysiol. Technol.* (1993) 19(2): prepared for the BSCN, in consultation with the ABCN and EPTA, by B. M. Evans, A. Kriss, D. Jeffries, M. Boland, P. Carter, and C. Fowler.

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Infection Control and the Electroneurodiagnostic Department: 1994 Guidelines. *Am. J. EEG Technol*.(1995): 35:3-36, written by C. Altman.
Report of the Committee on Infectious Diseases. *J. clin. Neurophysiol.* (1994) 11(1):128?32.

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