Microbe of the month

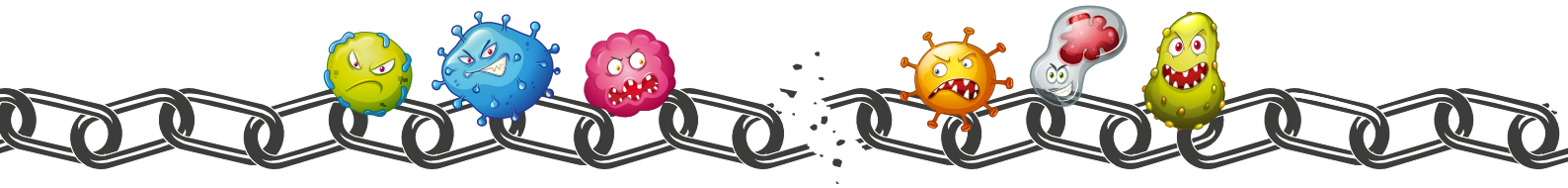
Breaking The Chain of Infection

Cutimed®

APRIL 2020

Newsletter

Compiled by Helen Loudon, Independent IPC Practitioner



Featured this month:

PRION DISEASE

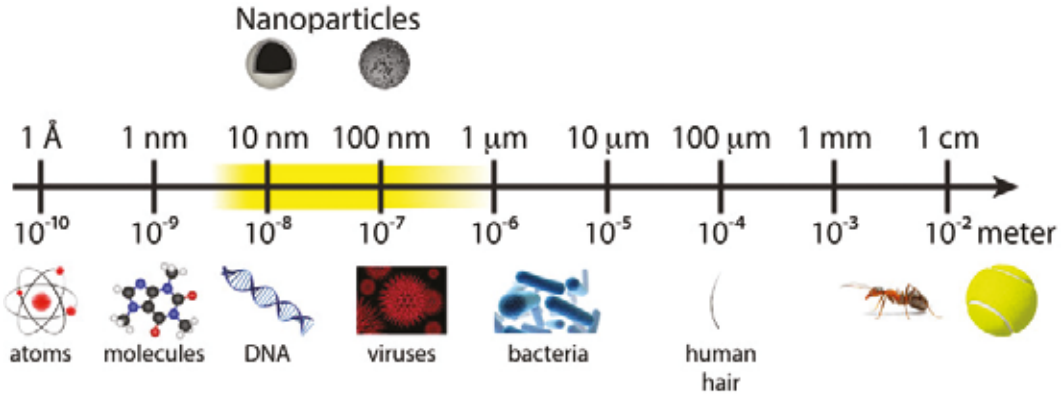
Protein particles resistant to all forms of disinfection and sterilisation!

Hello readers!

Have you heard of '**PRIONS**' before?

The term "**prion**" was coined from "**pro**tein infect**ion** particle" and refers to **infectious particles** that are transmissible and able to spontaneously induce (by mutation) abnormal folding, clumping and accumulation of otherwise normal cellular glycoproteins called 'prion proteins' found in the brain.

Prions, like viruses, are not considered to be living organisms and cannot be visualised microscopically. For example, a prion protein is a miniscule 10nm (nanometres) in size, whereas viruses are approximately 100nm in size, and bacteria range between 200nm and 1000nm.



Prion diseases are a family of rare progressive neurodegenerative disorders that affect both humans and animals (also referred to as '*transmissible spongiform encephalopathies*' or TSE's). They are distinguished by long incubation periods, characteristic spongiform changes in the brain associated with neuronal loss, and a failure to induce the normal immune response to infection.

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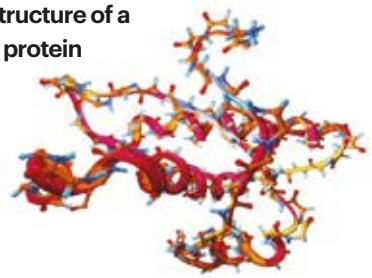
YouTube

The structure of a prion protein



Prion diseases are notoriously difficult to diagnose, rapidly progressive, untreatable, and invariably fatal.

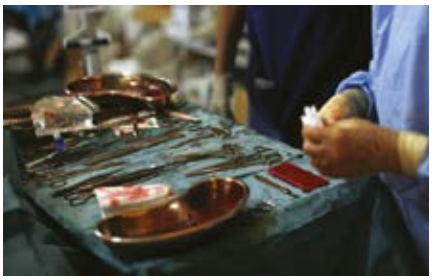
BACKGROUND – A CLEAR DISTINCTION BETWEEN THE TYPES OF CJD [1]

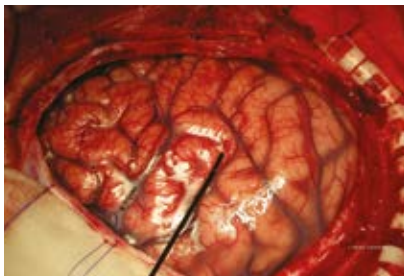
Human prion diseases include sporadic, familial (inherited), and variant **Creutzfeldt-Jakob disease** (CJD). Prion diseases in animals include 'Scrapie' in sheep and goats, and bovine spongiform encephalopathy (BSE) in cattle, often referred to as 'mad cow disease'.

Sporadic Creutzfeldt-Jakob disease is the most common and is pertinent to this issue of 'MOM' because it is potentially transmissible in the healthcare setting.

Important: *sporadic CJD is not related to 'Scrapie' or "mad cow disease", and is also distinct from "variant CJD", which is related to the ingestion of meat contaminated with BSE prions.*

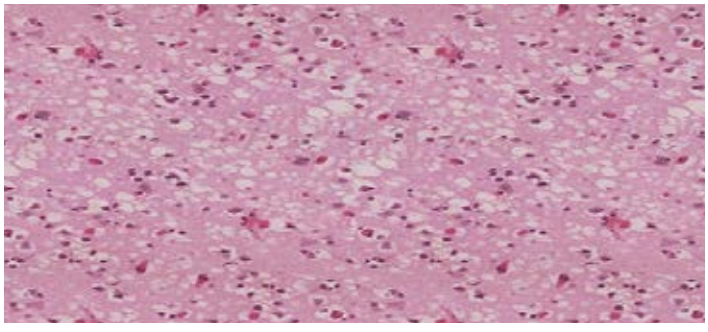
Acquired prion diseases are caused by exogenous exposure to abnormal prion proteins through ingestion and medical or surgical procedures.

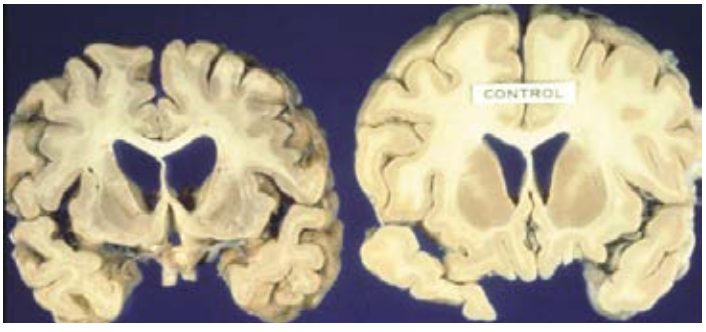




Creutzfeldt-Jakob disease (CJD) is a rapidly progressive, fatal neurodegenerative disorder which occurs worldwide.
CJD is estimated to affect 1 person per million worldwide each year.
There is no known treatment for CJD and it is invariably fatal within one year of the onset of symptoms.[1]

For example, Kuru occurs in tribes in Papua New Guinea that practice cannibalism; while 'variant **Creutzfeldt-Jakob disease**' (vCJD) was first described in 1996 in the United Kingdom from consumption of prion-contaminated beef from cattle affected by bovine spongiform encephalopathy (BSE). Iatrogenic (illness or disease caused by medical examination or treatment) CJD has occurred following the administration of growth hormones derived from infected cadaveric pituitary glands, dural graft transplants, dural matter in radiographic embolization procedures, corneal transplants, liver transplants, the use of contaminated neurosurgical instruments and transfusion with infected blood products.





The deposition and accumulation of abnormal 'prion proteins' in the brain results in brain tissue that appears to be riddled with holes when the brain is sectioned and stained post-mortem. Also above, the comparison between a normal human brain (control) on post-mortem and the atrophied brain of a patient with **Creutzfeldt-Jakob disease** (CJD).

Clinical relevance?

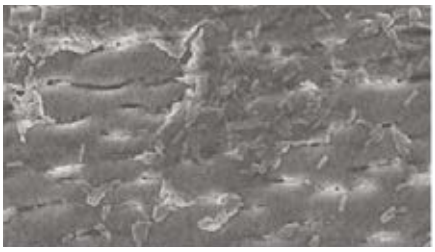
Exposure to brain or spinal tissue from an infected person may result in the transmission of prions via improperly reprocessed surgical instrumentation and equipment.

Tests indicate that prions can survive all forms of heat, radiation and disinfectant chemicals traditionally used in the healthcare setting!

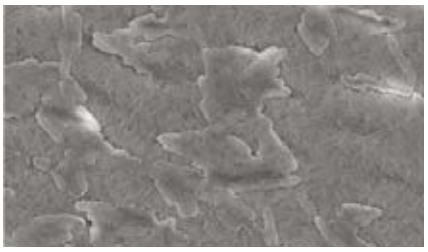
In their normal form, prion proteins are soluble in detergents and can be digested or destroyed by proteases (enzymes which lyse or break down proteins), *but in their abnormally folded and clumped form, they can resist the action of detergents and enzyme-based cleaning chemicals used in the CSSD*.

This highlights the extreme importance of meticulous pre-cleaning of surgical equipment and instrumentation prior to sterilisation!

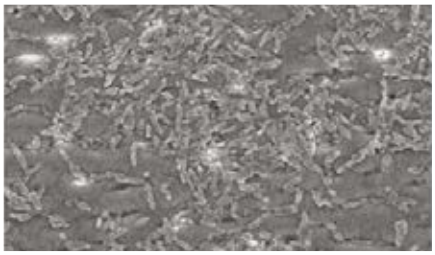
Look at the microbial contamination still present on the instruments below even after supposed manual and automated cleaning and exposure to a disinfectant!



Electron microscope image of microbial biofilm left behind on instrumentation after manual cleaning and disinfection with peracetic acid.



Biofilm left behind on a surgical instrument after automated cleaning and disinfection with 2% glutaraldehyde.



Gram-negative bacteria clearly visible after manual cleaning and disinfection with 2% glutaraldehyde.

SYMPTOMS AND DIAGNOSIS OF CREUTZVELDT-JAKOB DISEASE [1,2,3,4,5]

Early symptoms include memory problems, behavioural changes, poor coordination, and visual disturbances. Later symptoms include dementia, involuntary movements, blindness, weakness and coma.

Unlike other microbial infections for which blood and laboratory culture investigations can be undertaken, a definitive diagnosis of CJD requires analysis of brain tissue obtained by either biopsy or autopsy.

A probable diagnosis of CJD is supported by an elevated concentration of 14-3-3 protein in CSF (a non-specific marker of neurodegeneration), electroencephalogram (EEG), and magnetic resonance imaging (MRI) findings.

However, testing for TSE's is highly specialised, and will require prior liaison with an accredited laboratory.

Watch this informative 5 minute video

https://www.youtube.com/watch?v=PxtnBVIAwlc

LESSONS LEARNED FOR INFECTION PREVENTION AND CONTROL [6,7,8]

1. Prions are unique pathogens, because the misfolded and aggregated prion proteins are incredibly resilient to degradation. **Normal disinfection procedures** used for viral, bacterial and fungal pathogens, such as alcohol, boiling, formalin, dry heat (<300°C), autoclaving at 121°C for 15 minutes, and ionising, ultraviolet, or microwave radiation, **are either ineffective or variably effective against aggregated prions.**
2. Fortunately, CJD is not transmitted by direct contact, or by droplet and airborne spread.
3. Patient waste and body fluids should be handled as usual according to **standard precautions**; however, great care must be taken to avoid splashes and needle pricks, and all incidents should be promptly reported.
4. No special environmental precautions other than the normal disinfection of furniture and nursing equipment are required.
5. Private room nursing care is also not required for infection control, but would be appropriate for compassionate and terminal care reasons.
6. **Operating theatre and CSSD infection control guidelines** are always based on an assessment which considers the potential risk of infection associated with the use of instrumentation or a medical device. Therefore, terminal disinfection and sterilisation processes must factor in the prion bioburden that could result from contact with infectious neurological tissues.
7. As per '**Spaulding's classification**', the 3 categories to which surgical instrumentation and medical devices are assigned are '**critical**', '**semi-critical**', and '**non-critical**'. Items assigned to the critical category present a high risk of infection if they are contaminated with CJD, as this type of equipment is always used to enter sterile tissue or the vascular system.
8. **Surgical instruments potentially exposed to CJD** requires special disinfection protocols (using sodium hydroxide or caustic soda) to inactivate the prions. Therefore, it is advisable that single-use instruments should be used on high-risk tissue (brain, pituitary, dura, spinal cord, eyes) on patients at risk for prion disease, and be disposed of by incineration. Lower-infectivity tissue include the cerebrospinal fluid, kidneys, liver, lungs, lymph nodes, spleen and placenta of suspected or confirmed CJD patients, and should also be disposed of by incineration.
9. In the **microbiology laboratory** setting, safety cabinets and disposable cover sheets are used where possible to avoid environmental contamination, because prions are known to persist for long periods on surfaces. Surfaces contaminated by TSE agents can be disinfected with sodium hydroxide or undiluted sodium hypochlorite ('bleach'), followed by thorough rinsing with water. If the surface cannot tolerate NaOH or NaClO, thorough cleaning will remove most infectivity by dilution.

Contact your local Essity representative for back copies and to sign up for the 'Microbe of the Month' mailing list

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* P. J. Stanirowski, et al. Dialkylcarbamoyl chloride-impregnated dressing for the prevention of surgical site infection in women undergoing cesarean section: a pilot study. Arch Med Sci 2016; 12, 2

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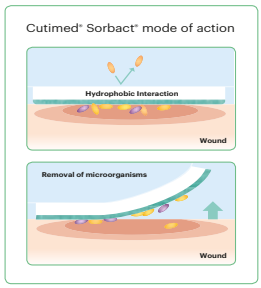

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72698-02	20 x 20 cm	17.8 x 17.8 cm	10	274716-001
72698-03	20 x 30 cm	17.5 x 27.5 cm	10	274717-001

Wound depth Superficial + deep **Wound phase** Infected Sloughy **Exudate level** Moderate to high

[1]Haycocks S, Chadwick P (2011). Use of a DACC coated antimicrobial dressing in people with diabetes and a history of foot ulceration. Wounds UK Vol 6 No 4
[2]Ljungh et al (2006) Using the principle of hydrophobic interaction to bind and remove wound bacteria. Journal of Wound Care, 15 (4): 175 80

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