Creutzfelt-Jakob Disease (CJD)

Introduction

Creutzfeldt-Jakob disease (CJD) is an illness of the nervous system that causes damage to the brain. (The disease is named after 2 German scientists). CJD is fatal, and there is no known cure. CJD is caused by an abnormal protein - a prion - that then contaminates the nervous system.

In some respects a prion is similar to a virus as it can replicate and cause disease. Unlike a virus, it is made entirely from protein and has no genetic material. This makes prions much 'tougher' than viruses or bacteria. They can survive extremes of heat and radiation. Antibiotic or anti-viral medicines have no effect on prions.

There are four different types of CJD.

Sporadic CJD

Sporadic CJD accounts for 85% of CJD cases, yet remains very rare. It is estimated that one death in every million is caused by sporadic CJD. What triggers sporadic CJD is unknown, but it normally affects people over 40 years of age. 66 people died of sporadic CJD in the UK during 2006.

Iatrogenic CJD

This type of CJD is the result of the infection being spread from someone with CJD through medical or surgical treatment. The majority of iatrogenic CJD cases happened through the use of human growth hormone, which is used to treat children of restricted growth.

Between 1958 and 1985, thousands of children were treated with the hormone, which at the time, was extracted from the pituitary glands (a gland that sits at the base of the skull) of human corpses. A tiny minority of those children developed CJD, as the hormones they received were taken from glands infected with CJD. Since 1985, all human growth hormone in the UK is artificially manufactured, so there is now no risk.

A few other cases occurred through receiving transplants of infected tissue, or coming into contact with surgical instruments that were contaminated with CJD. This happened because prions are 'tougher' than germs or bacteria, so the normal process of sterilising surgical instruments had no effect. Once the risk was recognised, the Department of Health tightened the guidelines on organ donation and the re-use of surgical equipment.

As a result, cases of iatrogenic CJD are now extremely rare. There were 6 deaths from iatrogenic CJD in 2006, though it is thought that the original infection could have happened up to 20 years ago.

Familial or genetic CJD

This is a very rare form a CJD caused by an inherited mutation of the gene that produces normal proteins. The altered gene seems to produce prions that then cause CJD. Only around two dozen families in the UK are known to be affected. There were 6 deaths from familial CJD in 2006.

Variant CJD (vCJD)

A new type of CJD, new variant CJD, now referred to simply as variant CJD (vCJD) was identified in 1996. Unlike sporadic CJD it affects mainly people in their mid twenties.

There is clear evidence that variant CJD is caused by the same strain of infection that causes what is known as mad cow disease (bovine spongiform encephalopathy or BSE) - a prion.

A government inquiry in 2000 concluded that the prion was spread through cattle feed, and had entered the human food chain. The evidence suggests that the most likely explanation for variant CJD cases is exposure to that prion (but there is no known link to sporadic CJD).

Strict controls have been in place since 1996 to prevent BSE from entering the human food chain

Cases of variant CJD seemed to have peaked during the years from 1996 to 2003. In 2000 there were 28 deaths from variant CJD, while there were only 5 in 2006. Some experts believe that the food controls have worked, and that further cases of variant CJD will continue to decline.

Other experts have warned that the people who died could have had a genetic trait that meant that the variant CJD affected them more quickly than normal. Other similar infections caused by prions normally take between 15 and 20 years before they become active.

They argue that many people could also have variant CJD, but the symptoms might not begin to show for many years to come.

All cases of CJD are carefully monitored by the National CJD Surveillance Unit.

Symptoms

The initial symptoms of CJD are psychological. A common initial symptom is depression.

The condition progresses rapidly, and other symptoms soon appear. In sporadic CJD, these tend to be confusion and memory problems. In variant CJD, they tend to be a worsening of the depression, anxiety, delusions (strong beliefs in things that are obviously not true) and hallucinations (seeing or hearing things that are not there).

Due to the symptoms, in its early stages CJD can often be misdiagnosed as dementia or depression.

Further symptoms follow as the person's nervous system continues to worsen. These include:

- involuntary jerks and tremors,
- sensations of cold or pain,
- a sense that the skin feels sticky,
- loss of coordination,
- muscle paralysis,
- problems seeing or hearing,
- difficulty speaking, and
- difficulty swallowing.

Most people with sporadic CJD will die within six months of diagnosis. Most people with variant CJD will die within a year of diagnosis.

Causes

CJD is caused by an infectious protein - a prion. Proteins are molecules made up of acids, that help the cells in our body to function.

The exact role of proteins in our brain is unknown, but it is thought they may have something to do with our long-term memory.

Proteins begin as a string of acids, and then fold themselves into a three dimensional shape. This 'protein folding' allows them to perform useful functions within our cells.

Sometimes mistakes happen during the protein folding, and the protein cannot be used by the body. These misfolded proteins are normally recycled by the body, but sometimes they can build up and cause problems, like Alzheimer's disease.

Prions cause even more problems. Not only do they fold into the wrong shape, they enter other brain cells and cause normal proteins to misfold as well. This causes the brain cell to die, releasing more prions to infect other brain cells. Eventually, clusters of brain cells are killed and replaced with deposits of prions - plaques. These plaques produce small holes in the brain, causing it to become sponge-like. It is the damage to the brain that causes the mental and physical impairment, and eventual death, associated with CJD.

Prions can survive in neural tissue - such as the brain or the spinal cord - for a very long time, even after the person or animal has died.

In the case of variant CJD it is believed that the infectious prion was spread through cattle, as they were fed meat and bone mix (MBM) that contained traces of infected brains or spinal cords. Then the prion was spread from cattle to humans, through mechanically recovered meat, which also contained small traces of infected brains or spinal cords.

Both the use of MBM and mechanically recovered meat has since been outlawed.

Diagnosis

The only definitive diagnostic test for CJD is to look at brain tissue. Brain tissue can be examined during life - a brain biopsy - or after death, during a post-mortem examination.

As a brain biopsy carries the risk of causing brain damage or seizures, it is only undertaken in a few cases, where the concern is that the patient does not have CJD but some other treatable condition.

Diagnosis of CJD is normally based on medical history, symptoms and diagnostic tests. A neurologist (a doctor who specialises in conditions of the nervous system) will carry out the series of tests to rule out other conditions with similar symptoms such as Alzheimer's, Parkinson's disease or a brain tumour. The tests can also check for some common signs of CJD. These tests include:

- **MRI scan** - an MRI scan of the brain can rule out other conditions, and find abnormalities in the brain that are distinctive to CJD.
- **EEG** - an EGG (electroencephalogram) scan can measure the electrical activity of your brain. Sporadic CJD is known to cause a distinctive pattern of electrical activity, which can be found by the EEG scan.
- **Lumbar puncture** - a lumbar puncture involves inserting a needle into the base of your spine and taking a sample of the fluid that surrounds the brain and spinal column - cerebro-spinal fluid (CSF). The fluid can be studied to rule out other conditions. It is also checked for a protein called 14-3-3. This protein is found in almost all cases of sporadic CJD and 50% of variant CJD.
- **Tonsil biopsy** - a small piece of tissue can be taken from the tonsils and checked for abnormal prions. These prions are present with sporadic CJD, but not variant CJD.

Prevention

Since the link between BSE and CJD was confirmed, strict controls have been in place to stop BSE entering into the human food chain. These controls include:

- A ban on feeding farm animals on meat and bone meal,
- the removal and destruction of all parts of an animal's carcass that could be infected with BSE,
- a ban on mechanically recovered meat, and
- testing on all cattle that are over 30 months old (experience has shown that infection in cattle under 30 months of age is rare, and even cattle that are infected have not yet developed dangerous levels of infection).

Blood transfusions

In the UK, there have been four cases of variant CJD associated with blood transfusions. In each of the cases, the person received a blood transfusion from a donor who later developed variant CJD. These people then went on to develop variant CJD themselves.

It is not certain whether the blood transfusion was the cause of the infection, as the people could have contracted variant CJD through dietary sources. Nevertheless, steps were taken to minimise the risk of the blood supply for transfusion becoming contaminated. These steps include:

- Not allowing people potentially at risk from CJD to donate blood, tissue, or organs,
- not accepting donations from people who have themselves received a blood transfusion in the UK since 1980,
- using imported blood supplies for anyone under 16 years of age, and
- removing white blood cells - which may carry the greatest risk of transmitting CJD - from all blood used for transfusions.

Treatment

There is no proven therapy or cure for any of the forms of CJD. Treatment is based entirely upon reducing symptoms through the use of medicines, and trying to keep the person as comfortable as possible.

Psychological symptoms of CJD, such as anxiety and depression, can be treated with sedatives and antidepressants. Other medicines such as clonazepam and sodium valproate can be used to treat symptoms of muscle jerks and tremors. Opiate based painkillers can provide effective pain relief.

When somebody is diagnosed with CJD they will be assigned a keyworker. It is the keyworker's responsibility to co-ordinate the specialist care team that somebody with CJD requires. The care team will not just include doctors and nurses, but also occupational and speech therapists, dieticians, incontinence advisers, terminal care teams and social workers.

The keyworker is normally from health or social services, such as a GP, neurologist or social worker. The keyworker will also liaise between local health authorities and the National CJD Care team, so that any gaps in local services can be met.

As the condition progresses, people with CJD will need significant nursing and practical support. As well as general help with feeding, washing and mobility, some people may need help with urinating. Often the use of a catheter - a tube that is inserted into the bladder and used to drain off urine - is required. Many people will have problems swallowing, and they may have to be given nutrition and fluids through a feeding tube.

It may be possible to treat people with CJD at home, but this will depend on the progressions and severity of the condition. The pressures of caring for someone with CJD can be distressing and difficult to cope with. Rather than coping at home, may carers prefer to use the services of a hospital or hospice.