

## Specific childhood brain & CNS tumours

There are several different types of brain and central nervous system tumour:

- Primitive neuroectodermal tumours (PNETs) are a type of small round cell tumour developing from migrating embryonal cells of the neural crest. PNET incidence is fairly steady from infancy to age 3, then gradually declines. Medulloblastoma, a form of PNET, is a highly malignant brain tumour comprising 14.5% of newly diagnosed cases in young people aged 20 or less. The incidence of childhood medulloblastoma is higher in males (62%) than females (38%). 40% of medulloblastoma patients are diagnosed before the age of 5, 31% are between the ages of 5 and 9, 18.3% are between the ages of 10 and 14, and 12.7% are between the ages of 15 and 19.
- Gliomas within the brainstem comprise 10-20% of all paediatric CNS tumours. They can occur at any age, although they generally present in childhood with the mean age of diagnosis at 7-9 years (Jallo [2006](#)). Astrocytomas are cancers of the brain that originate in star-shaped brain cells called astrocytes. They are graded according to their aggressiveness from 1 (least aggressive) to 4 (most aggressive), 4 being more common in adults than children. The incidence of astrocytomas peaks at age 5 with a second peak at 13. Up to 10% of childhood tumors of the central nervous system (CNS) are ependymomas, which are usually intracranial. The occurrence of ependymomas seems to peak at age 5 years and then again in adulthood. Among children aged 5-14, ependymomas are very rare.
- Meningiomas are primary tumours of the central nervous system, usually benign, but they can be malignant.
- Glioblastomas are aggressive brain tumours, more common in adults than children.

## Risk factors

The risk factors for specific childhood brain & CNS tumours are listed below, with the relevant references. Research linking risk factors to childhood brain & CNS tumours in general, again with references, are listed in section 1. The detailed references are in section 3.

### Astrocytoma

#### Family and genetic factors

Kuijten ([1990](#), [1993](#)) found astrocytomas were more common in relatives of children, especially those aged 0-4 years at the age of diagnosis. The children with astrocytoma were more likely to have a relative who suffers from seizures, especially childhood seizures, epilepsy, mental retardation and febrile convulsions.

In a study by Toledano ([2009](#)) two siblings developed astrocytoma aged 13 and 14. Genomic DNA testing in the family demonstrated a high degree of microsatellite instability.

## **Pre-conceptual, pregnancy and birth factors**

Birth by Caesarian section were linked to astrocytoma, but a history of miscarriage halved the risk (Bunin [1994](#)).

High birth weight (>4,000g) was associated with astrocytoma (Harder [2008](#) and Kuijten [1990](#)) and the risk increased the higher the weight.

Maternal consumption of cured meat (Pogoda [2009](#)) has been associated with a doubling of risk for astrocytomas. Antinausea medication has been linked to astrocytoma in the child (Kuijten [1990](#)). Maternal use of any illicit or recreational drug, especially the use of marijuana was associated with an increased risk of astrocytoma (Kuijten [1990](#)) in their offspring.

## **Environmental factors**

Mothers' occupational exposures to insecticides, herbicides and non-agricultural fungicides were associated with a slight increase in astrocytoma (van Wijngaarden [2003](#)).

Wood preservative exposure was linked to astrocytoma risk (Schüz [2001](#)).

Mueller suggested ([2004](#)) that the risk of astrocytoma may be associated with the levels of nitrite found in drinking water, and recommended a closer evaluation of well water content. Thompson ([2010](#)) found an increased risk in astrocytoma in the children whose mothers lived in an American watershed at the time of birth. The authors considered the possibility that the foetus was exposed to environmental toxins through maternal consumption of contaminated water.

## **Astroglial tumour**

### **Pre-conceptual, pregnancy and birth factors**

Li ([2009](#)) suggests a possible association between maternal occupational ELF-EMF exposure shortly before and during pregnancy (including among sewing machine operators), and astroglial tumours in their children.

### **Parental occupational and lifestyle factors**

Paternal exposure to polycyclic aromatic hydrocarbons (PAHs) increased the risk for astroglial tumours (Cordier [2004](#)) and maternal exposure to solvents or kerosene at a high level increased the risk of astroglial tumours (Bunin [1994](#), Cordier [1997](#)).

## **Ependymoma**

### **Family and genetic factors**

The incidence of ependymoma in males is higher than in females.

### **Pre-conceptual, pregnancy and birth factors**

Maternal consumption of cured meat (Pogoda [2009](#)) has been associated with a doubling of risk for ependymomas. Maternal smoking during pregnancy was linked to an increased risk of ependymoma (Schüz [2001](#)).

Schmidt (2009) found no seasonality for CNS tumours in general, but ependymoma showed a seasonal variation.

## Medulloblastoma

### Family and genetic factors

A 5-year-old boy diagnosed with medulloblastoma was found to have 12 times the amount of L-2-hydroxyglutaric aciduria in his urine. There were other inherited characteristics that suggested a potential aetiological factor (Yazici 2009). The incidence of medulloblastoma in males is higher than in females.

### Pre-conceptual, pregnancy and birth factors

The peak month of birth for a risk of developing medulloblastoma is October, according to findings by Hoffman (2007), especially females aged 5-19. The authors suggest an environmental exposure may be responsible. Harder (2008) found that medulloblastoma was associated with high birth weight.

Maternal use of a sauna close to conception or in the first trimester, and paternal use in the 3 months before the pregnancy, use of an electric blanket, or any heat source have been linked to an increased risk of medulloblastoma. Heat and magnetic field exposure would both have been involved (Bunin 2006), and both may have contributed.

Cured meats combined with low vitamin C intake Bunin (2006), or oil products (Pogoda 2009), or french fries, chilli peppers and non-chocolate candy (Bunin 2005) consumed in pregnancy have been associated with an increased risk of medulloblastoma.

### Parental occupational and lifestyle factors

An increased risk of medulloblastoma was associated with paternal lawn care using pesticides and a weak association with stripping paint, both during pregnancy and after the birth of the index child (Rosso 2008).

### Infections

Harding (2009) concluded that an early exposure to infections is not strongly implicated in the aetiology of CNS tumours, but the effect for social contact outside the home, particularly for medulloblastoma warrants further investigation.

## Primitive Neuroectodermal Tumours (PNETs)

### Family and genetic factors

Kuijten (1993) found cancers were significantly more common in relatives of children, especially those aged 0-4 years at the age of diagnosis, with PNET.

### Pre-conceptual, pregnancy and birth factors

Stålberg (2007) found an increased risk of PNET with prenatal abdominal X-ray exposure.

Beer consumption during pregnancy has been associated with a four-fold increase in PNETs (Bunin [1994](#)). French fries, chilli peppers and non-chocolate candy eaten in pregnancy were associated with an increased risk of PNET (Bunin [2005](#)).

### **Parental occupational and lifestyle factors**

Paternal exposure to polycyclic aromatic hydrocarbons (PAHs) increased the risk for PNETs (Cordier [2004](#)) and maternal exposure to solvents or kerosene at a high level increased the risk of PNETs (Bunin [1994](#), Cordier [1997](#)). An increased risk of PNET was associated with paternal lawn care using pesticides and a weak association with stripping paint, both during pregnancy and after the birth of the index child (Rosso [2008](#)).

PNETs (Bunin [1994](#)) have been associated with both maternal and child exposure to pigs, poultry, dogs and cats. Children who were on a farm for more than a year and were first on a farm when they were less than 6 months of age (Holly [1998](#)) had an increased risk for PNETs, as did the children of mothers who ever had worked on livestock farms (Efird [2003](#)).

### **Infections**

Harding ([2009](#)) concluded that an early exposure to infections is not strongly implicated in the aetiology of CNS tumours, but the effect for social contact outside the home, particularly for PNET warrants further investigation.

## **Protective factors**

### **Astrocytoma**

A history of miscarriage or stillbirth halved the risk of astrocytoma (Bunin [1994](#), Kuijten [1990](#)).

Cruciferous vegetables (e.g. cabbage, brussels sprouts, broccoli, cauliflower) eaten during pregnancy are associated with a decreased risk of astrocytoma (Pogoda [2009](#)).

### **Astroglial tumour**

Maternal consumption of fresh fish is associated with a decreased risk of astroglial tumours (Pogoda [2009](#)).

### **Medulloblastoma**

Children who suffered from asthma and eczema, amongst other atopic conditions, showed a reduction in risk for medulloblastoma (Harding [2008](#)).

A history of spontaneous abortions was negatively associated with neuroblastoma risk by Munzer ([2008](#)).

Vitamin use during pregnancy and iron in both diet and as supplements was associated with a reduced risk of medulloblastoma (Bunin [2006](#)).

## **PNET**

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