INFANTILE SPASMS
AND
WEST SYNDROME

An explanatory booklet for parents
and for professionals

written by

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With grateful thanks to the parents who gave permission for
their child's photgraphs to be used in this document.

INTRODUCTION

This booklet has been written to help parents understand what may be happening when their infants are thought to have infantile spasms or West syndrome. It will be made freely available on the internet where it may be kept more up to date than is possible in the printed version. The diagnosis, management and understanding of infantile spasms or West syndrome can be complicated. It will be important for parents to discuss their questions with their own doctor. But it is hoped that this guide will help parents wanting to know more about the condition. Because it is a rare condition, affecting only about one infant in 2,500, the information will also be useful for many professionals. Most district hospitals in the United Kingdom will only have about one or two infants each year who are brought to them because of this condition. The average General Practitioner would have to work for over 100 years before they would have an infant present to them with this form of epilepsy.

HISTORY

In 1850, Dr West wrote a letter to the Lancet, an English medical journal. In this letter he described what was happening to his son, James. James had developed a form of epilepsy we now know as infantile spasms but often called West syndrome in recognition of this first known report of the condition. Dr West asked if anyone had any information about the condition, but there is no evidence that he ever received a reply. His description was "*bobbing of the head, complete heaving of the head forward towards his knees, and then immediately relaxing …… these bowings and relaxings would be repeated alternately at intervals of a few seconds, 20 or more times at each attack, which attack would not continue more than 2 or 3 minutes*." In this booklet, we will refer to infantile spasms to describe the condition. We will use the term West syndrome for some, but not all infants with infantile spasms. We will explain why later.

Epilepsy is a collection of conditions, each of which can be diagnosed as different from other epileptic conditions. All epileptic conditions are thought to occur because of an electrical disturbance in the brain. This disturbance is thought to happen when a group of nerve cells all release small quantities of electricity at the same time. The electrical disturbance can often be detected using an EEG or electroencephalogram. We will explain more about this later.

WHEN DO INFANTILE SPASMS USUALLY BEGIN?

Most infants with infantile spasms develop a pattern of movements called spasms, sometimes also referred to as epileptic spasms. The most common age for these spasms to begin is between 3 and 6 months of age. They can begin earlier than 3 months and sometimes begin after 12 months of age. For this reason, infantile spasms is often referred to as an age dependent epilepsy. It is likely that this age dependence is due to the stage of development of the brain.

WHAT ARE THE SPASMS LIKE?

The spasms themselves only last a few seconds, usually only one or two seconds. Usually several spasms occur together in what is called a cluster. The infant usually appears to recover or relax between each spasm. There may only be a few spasms in a cluster or there may be many, even more than one hundred. Very occasionally, only one spasm will occur at a time. In between clusters of spasms many hours without spasms can occur. Occasionally more than a day will pass without a cluster of spasms. Clusters of spasms often occur after waking from sleep, whatever time of the day.

When an infant has a typical spasm, there are several movements. The head nods forward, the arms spread out and up and the legs may or may not lift up towards the abdomen. These movements may be accompanied by a little cry or the child may cry after the spasm. This movement lasts 1 – 2 seconds only. Any movement like this but lasting much longer – perhaps 10 or 20 seconds – is likely to be a tonic seizure and not an infantile spasm. The gap between each spasm in a cluster lasts for a variable length of time. This gap may only be a few seconds or may be a minute – or perhaps longer. Sometimes the gap between spasms gets closer as the cluster starts but then gets longer towards the end of the cluster.

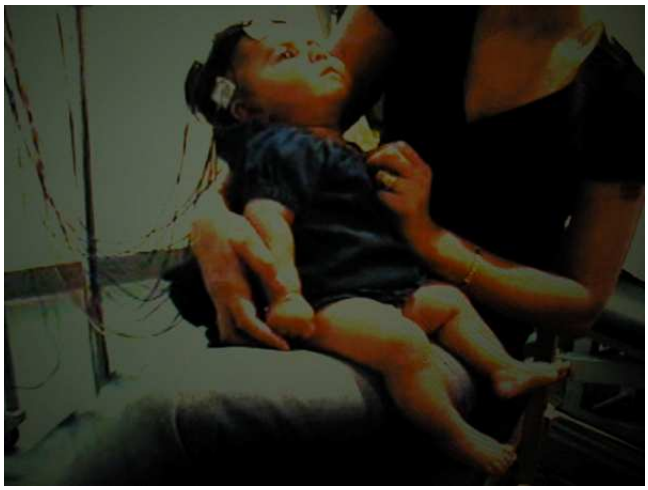
Pictures showing a child having infantile spasms during an EEG. The picture on the left is before the spasm. In the picture on the right the arms have been lifted up and slightly outwards, the eyes have opened and the head has bent slightly forwards.

Some infants will be perfectly well one day but the next day they begin to have obvious infantile spasms. But sometimes when the infant first starts to have spasms, they are often less obvious. Sometimes only the head nods. Even less common are infants whose eyes move but whose head and limbs do not. When the spasms first start it is often thought that the infant has colic or a startle reaction rather than epilepsy. But, the movements of spasms are not usual with colic.

WHAT WILL HAPPEN IF MY CHILD IS THOUGHT TO HAVE INFANTILE SPASMS?

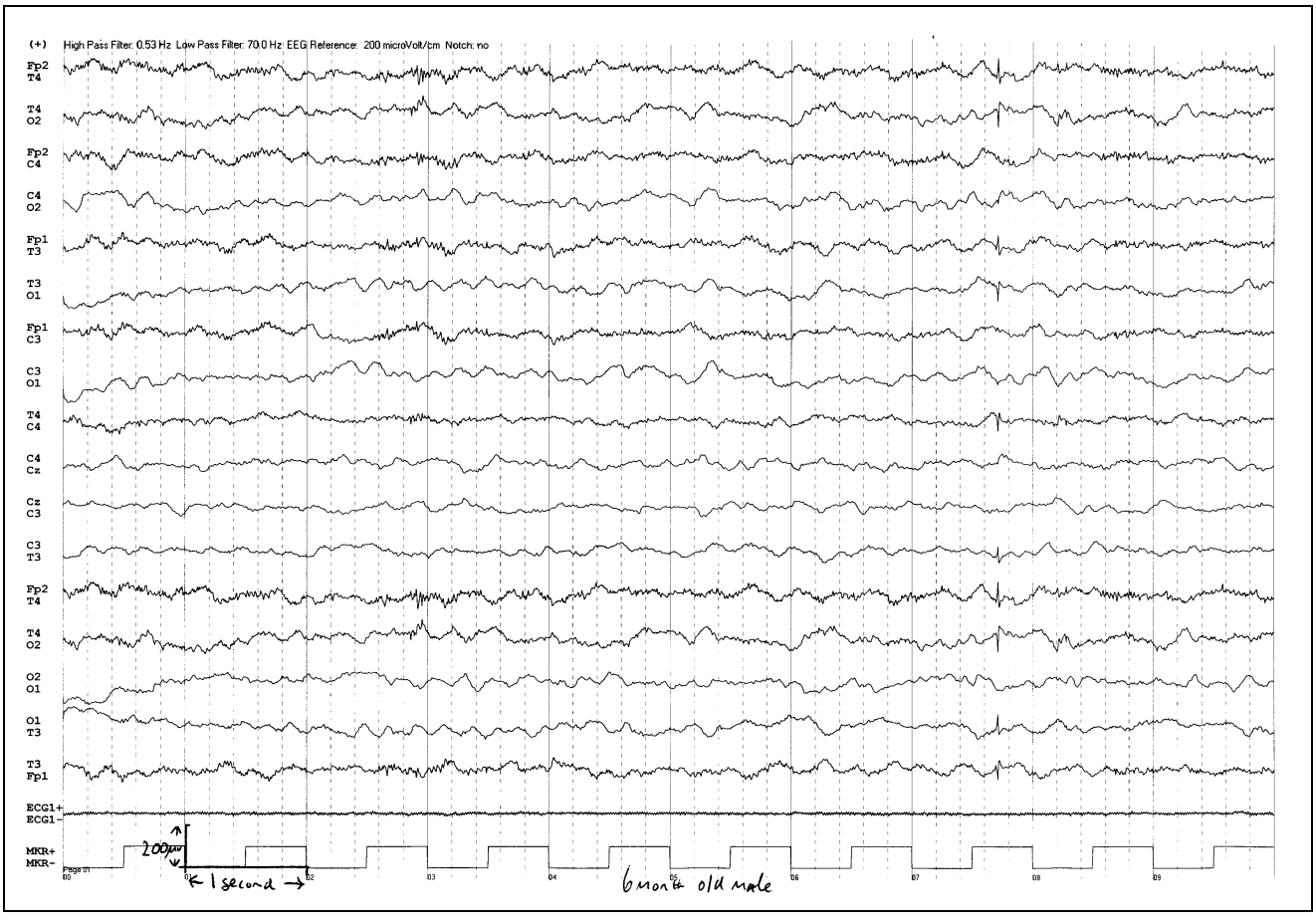
If an infant is thought to have infantile spasms, they need urgent referral to hospital. For many years it has been thought that treating the spasms is not urgent, but recent research suggest that treatment might be needed urgently. In hospital, the specialist will listen carefully to the description of the movements and if the specialist thinks an infant might have infantile spasms, the first investigation is an EEG. This test measures the amount and type of electrical activity the infant's brain is producing. It involves placing little metal discs on the skin of the infant's head and connecting them to a computer.

If the child has infantile spasms, the EEG is usually very different from normal even when the spasms are not happening. Sometimes the EEG is only abnormal when the infant is asleep, so it may be important to record the EEG while your child falls asleep. The electrical activity is usually very much stronger than normal. Doctors call this "high voltage" and in infantile spasms it is often very high voltage. The activity is also very different in quality being disorganised with activity occurring in different parts of the brain at different times. There are usually spikes, or sudden activity which just as suddenly returns to the previous level. In children without infantile spasms who are developing normally, the EEG activity is organised and coordinated and does not have spikes. Spikes are common in most forms of epilepsy. When the EEG shows the most typical features of the infantile spasms, it is said to show hypsarrhythmia. Sometimes the EEG clearly demonstrates that infantile spasms are occurring but does not show the typical features of hypsarrhythmia. It may not matter whether the EEG is said to show hypsarrhythmia. But it does matter that the EEG shows features that suggest the cause of the spasms is the epilepsy called infantile spasms.

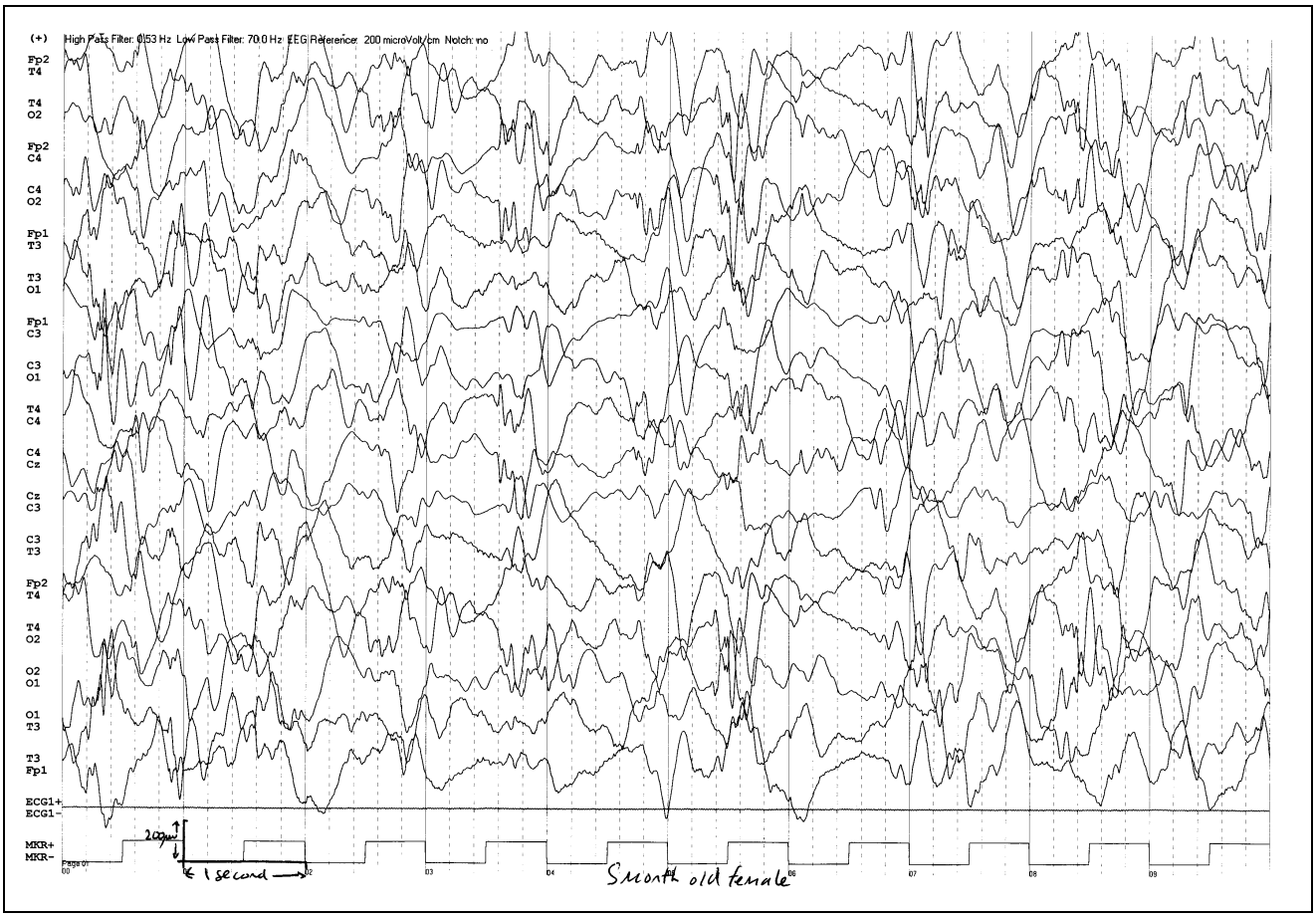


Picture showing a child having an EEG

Doctors can get confused if the EEG is not reported as showing hypsarrhythmia. But recently, an international collaboration of doctors suggested that to avoid confusion, we should use the term West syndrome when we have both the clinical appearance of spasms and hypsarrhythmia on the EEG. If the EEG confirms the diagnosis but does not show typical hypsarrhythmia, the condition should be called infantile spasms. The term infantile spasms can be used for infants with West syndrome and infantile spasms collectively. The EEG may not show typical hypsarrhythmia because the spasms have been going on for some time, or because medication has changed the EEG or because the condition which put the child at risk of having infantile spasms has itself caused changes to the brain's electrical activity – which changes the EEG. There may be other reasons too which doctors have still to learn about.



This shows part of an EEG taken from a 6 month old baby boy. It is normal.



This shows an EEG taken from a 5 month old baby girl who had infantile spasms. The EEG shows hypsarrhythmia. It is very high voltage, has spikes which arise from more than one area and has "slow" activity – waves which take some time to go up and down, unlike spikes which jump up and down very quickly.

WHY IS MY CHILD IS NOT RESPONDING TO ME?

Some infants may be at risk of slow development because of the condition already affecting the brain before the onset of spasms. But many parents notice that their infant behaves differently when the spasms start. Their child may loose interest in their surroundings, taking less notice of their parents. Some infants become irritable or drowsy. Parents often wonder what is happening because of this change in personality. But not all infants show this change. It used to be thought that infants had to suffer from this and from delayed development before doctors should use the name West syndrome. But it is not necessary for the infants to have abnormal development before calling the condition either infantile spasms or West syndrome. That is because some infants with infantile spasms will continue to have normal development.

ARE THERE OTHER CONDITIONS WHICH LOOK LIKE INFANTILE SPASMS?

Very occasionally when the EEG is done it is completely normal, even when the infant is asleep. This can occur even when the spasms seem to be typical spasms. These infants do not have infantile spasms or West syndrome and are said to have "benign infantile myoclonus". This is not a type of epilepsy and the normal EEG has shown that the spasms are not epileptic spasms. Benign infantile myoclonus does not need treatment and infants with this condition will develop normally with no increased risk of epilepsy or learning difficulty. It is important therefore to have an EEG before starting treatment for infantile spasms. No one wants to start treatment in an infant when it is not needed. But the EEG must be normal during sleep to diagnose benign infantile myoclonus.

WHY DID MY CHILD GET INFANTILE SPASMS?

About half of infants with infantile spasms are known before the spasms start to have a disease or disorder that affects the brain. Perhaps there was a problem before the child was born. If this problem occurred at a very early stage then the brain may not have been built correctly. This problem might be obvious and the parents might already know that it exists or it may need investigations to find it. Perhaps there was a problem around the time of birth and the brain was developing normally but was damaged. Damage to a normal brain can occur to babies during pregnancy or child birth. It can also occur in babies born prematurely – usually before 32 weeks of pregnancy where the brain is not yet strong enough to withstand being born. Damage can also occur after birth from meningitis or trauma for example. But even after investigations are complete, we still do not know why the condition has started in about one third of infants.

If you read about infantile spasms, you will come across words about the causes of infantile spasms. Often, doctors talk about idiopathic, cryptogenic and symptomatic causes. But, these words are confusing and different doctors use them in different ways! Most often symptomatic means that a cause has been found, cryptogenic means that a cause ought to be found and idiopathic means that a cause can't be found. But it is best not to use these words if we can't all agree how to use them.

WHAT PARTS OF THE HISTORY AND EXAMINATION ARE MOST HELPFUL?

Your doctor will already have spoken to you about the pregnancy, childbirth and the days after birth. Any problem during pregnancy or childbirth, including being born premature (usually earlier than 30-32 weeks), if bad enough to be a risk to the child's development may be the reason why the child developed infantile spasms. They will also have asked you about family history in case there is any clue there. It is rare for infantile spasms to occur in other family members. Has your child had any serious illnesses since birth such as meningitis? Then your child will have been examined. The following parts of an examination are most important:

1. Eyes: most infants will have their eyes examined. First of all the doctor will put drops in the eyes to make the pupils (the dark part) bigger. This makes it much easier to see the back of the eye. Because the eyes are formed from the brain they often give us a clue about the development of the brain.

2. Skin: examining the skin can also give clues about some of the causes but it rarely makes the diagnosis. Most often, examining the skin points to the most useful investigations to do next. White patches can suggest the diagnosis. An ultraviolet light, sometimes called a Wood's light, is used to look for these white patches. The patches are called "hypomelanic macules" and they suggest that the child may have a condition called tuberous sclerosis. But a brain scan will usually be needed to be certain of this diagnosis. The Wood's light may also find patterns in the skin which suggest other diagnoses.

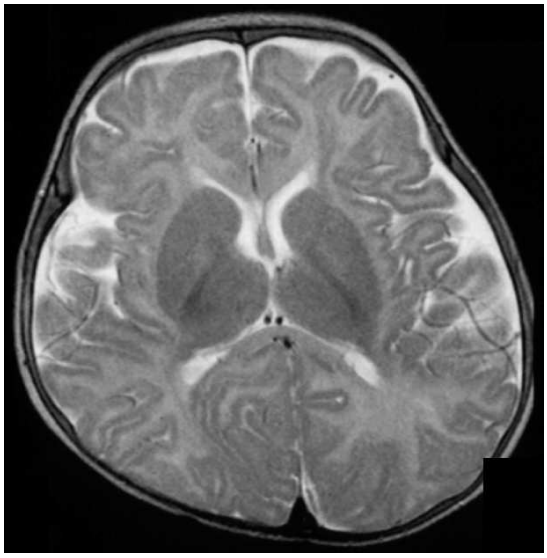
3. An examination of the infant's nervous system might show problems. The most common problems would be cerebral palsy or slow development. Very occasionally, the infant's head might not be growing properly. Most of these problems are found in an infant whose parent's already are worried that there is something wrong with their child's development or where a diagnosis of a problem has already been made before the spasms begin. It is very difficult to judge whether an infant's development is delayed once the spasms start because most of the infants do not respond normally while the spasms continue.

WHAT INVESTIGATIONS WILL MY CHILD NEED?

If it is not clear why your child developed infantile spasms after talking to you and examining your child, then investigations will be needed. Even if it seems obvious what the cause is, your child may need investigations to be certain. The following investigations are usually done:

1. Your child will often have a brain scan. The exact type of scan done may depend on what is available most quickly or on what is most likely to help if examination has suggested a possible cause. A scan will produce pictures of how your child's brain has been built. It may show damage if some damage has happened. But it does not show how well the brain is working. Looking at a brain scan is a little like

looking at a drawing of a building. It will show you how it has been built but it will not show you if the people inside the building are working properly. But, it may show something which tells you that there will always be some problems with the way the brain works. There are two different types of scan, a CT scan and an MRI scan. CT scans are much quicker to do and give different information but they use x-rays. MRI scans use very strong magnetism to produce their pictures of the brain. So MRI scans do not use x-rays and that is better for little infants. But an MRI scan takes much longer to do. It is important for both scans that the infant does not move during the scan. If a small infant can keep still for long enough after a feed, a CT scan can sometimes be done without an anaesthetic or sedation. An MRI scan is noisy as well as taking longer. Often an infant will need an anaesthetic in order to keep still for long enough to do an MRI scan. An MRI scan finds a cause for infantile spasms more often than a CT scan. But, it is possible, but not common, for a CT scan to find something which an MRI scan has not found. Sometimes a CT scan is done first and the MRI scan is only done if the CT scan does not help explain the cause.

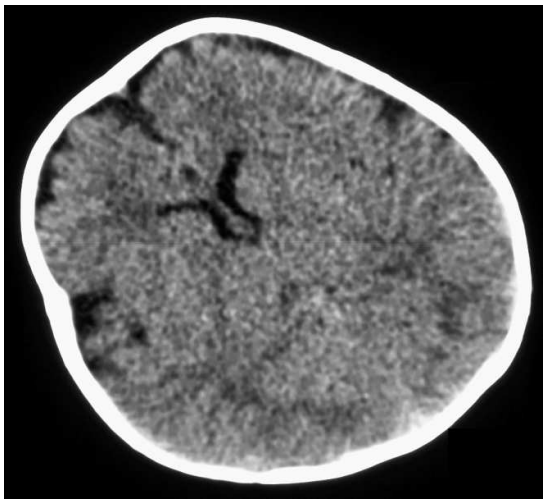


This figure shows the sort of picture obtained with an MRI scan in an infant with no brain abnormalities.

The picture is called a "slice" because it looks at the structure of the brain a few millimeters in thickness. It is shown as if you are looking from above. The eyes are at the top but are below this slice so they can not be seen.

On this picture, the fluid is shown as white so you can see fluid around the brain and near the middle too.

The dark areas are called the nuclei. They are relay stations for messages.



This figure shows the sort of picture obtained with a CT scan in an infant with no brain abnormalities.

The picture is also called a "slice" because it also shows a picture of the structure of the brain which is a few millimeters thick. The baby is lying with their head turned to the left, so the eyes are at the top left corner, but again are not visible. The fluid here comes out black.

2. Metabolic disease must be looked for. A metabolic disorder is a problem with the way the body uses proteins, carbohydrates or fats. It is important to make sure that the infant does not have a condition called phenylketonuria. In phenylketonuria, it is protein which is the problem. It is usually detected in newborn babies with a test still referred to as a Guthrie test. This is one of the blood tests done on all babies in the United Kingdom at about 7 days of age. But it is easy to check again and as it is a treatable

condition, it is important to look for it. The exact test done varies from laboratory to laboratory but will involve looking at the urine or blood for amino acids. These tests will also find other less common metabolic diseases which might cause infantile spasms.

3. Most infants will also have blood tests to look at the blood count, kidney function and liver function. Many will have the blood calcium or magnesium done. But it is not likely that these tests will explain why the infant has spasms.

4. If tuberous sclerosis is suspected, then the infant may need a heart scan or a kidney scan to make certain of the diagnosis.

5. If there are still no clues why your infant developed infantile spasms, then the level of lactate may be tested in the blood and CSF (CSF or cerebro-spinal fluid is the fluid which surrounds the brain). The CSF may also be tested for sugar and for glycine. The fluid shown in the pictures is CSF.

6. The chromosomes may be examined. The chromosomes carry our genes – the messages which are inherited from our parents and which tell our bodies how to work. If the child has any special appearance, then other special tests may be done on the chromosomes.

7. Research is looking to see if tests of particular genes associated with other epilepsies may help. In infants with other seizure types in addition to infantile spasms, if the spasms do not respond to treatment.

8. Pyridoxine may be given to see if the child has pyridoxine dependent seizures. This is the only quick way to diagnose this rare condition. It is not thought to occur in children with infantile spasms unless they have already had other seizure types before the spasms began.

WILL MY CHILD GROW UP NORMALLY?

Unfortunately, all infants with this condition have a high risk of having slow development after the spasms start. Some infants will stop having the spasms and will go on to develop normally. It is because of the risk of poor development that doctors like to start treatment as quickly as possible. We are not certain that starting treatment quickly will help to protect infants from poor development. We know that when the spasms stop quickly, the infant has a better chance of good development. But this is probably because the "amount" of brain damage causing the spasms to appear is less in these infants – so it is easier to stop the spasms. There are some bits of information though which suggest that whatever the "amount" of brain damage, the quicker the spasms stop the better the infants development will be. There is no evidence that treatment must begin within hours or even within a few days of thinking the child has spasms, so there is time to get the EEG.

WHAT TREATMENT IS AVAILABLE TO HELP MY CHILD?

Most parents would like to see the spasms stop quickly anyway because they are distressing to see. Sometimes the spasms clearly upset the infant as they happen. So as soon as we know that the condition is infantile spasms because the spasms look typical and the EEG supports the diagnosis, treatment is offered as quickly as possible. So, what sort of treatment can be offered to help stop infantile spasms or West syndrome? It has always been a difficult type of epilepsy to stop. For many years the usual treatments offered for other types of epilepsy did not seem to work. Some might even have made the condition worse. And all the treatments we use have side effects – but the side effects are much less serious than not treating the child.

HORMONAL TREATMENTS WITH TETRACOSACTIDE OR PREDNISOLONE.

In 1958, some doctors discovered an injection which would often stop the spasms. This injection made the infant produce more natural steroid than is usual. This injection is called ACTH which stands for Adrenal Cortical Stimulating Hormone. Just above the kidney on each side of the abdomen, is the adrenal gland. Normally this gland produces cortisone from it's outer segment or cortex. Cortisone is the body's natural

steroid hormone. The amount produced depends on how much stimulating hormone is excreted from another hormonal gland in the brain called the pituitary gland. If no cortisone is produced, then we all fall ill. We all depend on steroid hormones to keep us alive. Too much cortisone over a long time is not good for us either and will again make us ill. So, the body controls the amount of cortisone produced by varying the amount of stimulating hormone, or ACTH, which is produced. Normally more cortisone is produced first thing in the morning than in the evening. Even more is produced if we are ill. It was not long before doctors tried giving a type of cortisone by mouth to make it unnecessary to give injections. Most often, the type of cortisone used is called prednisolone. Prednisolone is a man made type of natural cortisone. We do not know for certain why giving either ACTH or prednisolone helps to stop spasms but we are certain that they do help. Tetracosactide is man made ACTH. It is much safer because ACTH used to be obtained from dead cow's or dead pigs. But tetracosactide still has to be given by injection. Even though these hormonal treatments have been used for many years, there is still some doubt about how much to give, how long to give it for or which is the best. It is clear that "low dose" prednisolone is not as good as tetracosactide but big doses do seem to be as good.

TREATMENT WITH VIGABATRIN.

In the 1990's, a new anti-epileptic medication was found to be good at stopping infantile spasms. It is called Vigabatrin. It is often called the first designer drug for epilepsy, because it was designed to increase the amount of gamma aminobutyric acid, or GABA for short, found in the brain. GABA is a major chemical in the brain and it inhibits nerve cells from transmitting impulses to the next nerve cell. Doctors found that it worked well in infantile spasms and it is still the only anti-epileptic medication which does work well.

OTHER TREATMENTS

Other anti-epileptics which sometimes help are nitrazepam, sodium valproate, topiramate, lamotrogine and sulthiame. Pyridoxine, a vitamin, is also sometimes used but there is little evidence to show if it really works. Newer medications such as zonisamide are being used in Japan. If neither tetracosactide, prednisolone nor vigabatrin works, it is often difficult to stop the spasms.

DO WE NEED TO TREAT THE ABNORMAL EEG IF THE SPASMS HAVE GONE?

The EEG appearance of hypsarrhythmia is so abnormal that some doctors have worried that even if the spasms have gone that if the EEG still shows hypsarrhythmia that the treatment should continue. There is no evidence to support this view. It is clear that if the hypsarrhythmia continues after the parents think the spasms have gone, that sometimes the spasms are still there but are so subtle that they have been missed. It is also clear that the spasms do not have to disappear on the day the hypsarrhythmia disappears. There may be a delay of several days between the two events. So, best advice is if the hypsarrhythmia continues, make certain that spasms have gone. If necessary take videos after the infant wakes up or record an EEG with the video running and include a period of waking from sleep. But don't continue the treatment just because the EEG is still abnormal. It is rare for the EEG to return to normal – so just make sure the features on the EEG which suggested the diagnosis have disappeared.

HOW DO DOCTORS DECIDE IF TREATMENT WORKS?

First of all, it is important to know that the spasms have gone. Some infants will go one day without spasms only for them to happen again the next day. Occasionally two days without spasms will be followed by the spasms coming back on the third day. Doctors do not usually say the treatment has worked until the spasms have gone for at least 48 hours and preferably for longer. A recent review of specialist opinion felt that the spasms should have gone by the end of the 14^{th} day of treatment and that they should not have come back for at least 28 days before the treating doctor should call this a response. But even this can be followed by the spasms coming back. Most doctors also like to see the EEG appearance which supported the diagnosis return to a more normal state. But the EEG may not return to normal because other problems with the brain also cause abnormalities on the EEG. If the spasms do come back, they can always be treated again.

Doctors and the public can look at information from research to decide how good a treatment is. But it can be quite difficult finding all available information. And it can be quite difficult to decide how reliable that information is. A few years ago, a group of researchers set up the Cochrane Collaboration. This requires researchers to look at all available information on treating a disease. The researchers then use proven methods to analyse all the available information to see if we can be certain which is the best treatment. Studies have shown that ACTH, prednisolone (in full dosage) and vigabatrin all work, but ACTH and prednisolone work faster than vigabatrin and this may lead to better developmental progress.

HOW QUICKLY DOES THE TREATMENT WORK?

The spasms can stop quickly or take a few days to stop. If the first treatment has not shown any signs of working after 14 days, then it is usually time to change to another treatment. Sometimes it is obvious that the spasms are about to stop because each day fewer spasms occur and at this rate within a few days, all the spasms should have gone. Then it may be best to wait for a few days to see if the spasms do stop.

WILL THE SPASMS COME BACK?

Sometimes the spasms disappear and are never seen again once the initial treatment works. Sometimes they disappear only to come back later. Usually this happens within 3 months but it can happen later. When they reappear, doctors call this a relapse. The spasms can be treated again and can still disappear once more. Relapse is disappointing but it may not be too serious if the spasms go away again with more or new treatment.

HOW LONG WILL MY CHILD NEED TREATMENT?

This depends on which treatment is being used. Hormonal treatments and Vigabatrin are both usually given for 14 days before deciding to try something else if they have not worked. The best chance of success is in the first 7 days but there is still a reasonable chance of success in the second week of treatment. All available information suggests that for these treatments, it is important to use the proper dose and not to give too little. Hormonal treatments are used for a limited time and do not have to be continued all the time for the child to be free of spasms. Vigabatrin is usually continued for some months.

WILL MY CHILD ALWAYS HAVE SPASMS OR EPILEPSY?

The spasms will have disappeared by the age of 14 months in about three quarters of infants with this disorder. After this age the spasms can still come back but this is not common. infantile spasms can continue through to school age if they do not respond to treatment but eventually they do stop on their own. Some infants will develop other types of seizure. The other types of seizure include drop attacks, tonic-clonic seizures, focal seizures, myoclonic seizures, absences or blank spells (but not usually typical absences). This can happen to any child with infantile spasms but it is most common in infants whose spasms do not stop easily.

WILL MY CHILD DIE?

Some of the conditions that cause infantile spasms do put the infant at risk of death but these are not very common. But, if the spasms continue for months, this can have a bad effect on the infant. Either continuing epilepsy or an intercurrent infection may prove too much for the child who could die from these problems. Our best estimate is that about one child in 20 will die before they are 15 months old and a similar number will die before school age.

WHERE ELSE CAN I LOOK FOR INFORMATION?

First of all, ask your specialist. They know details about your child. This will help them to tell you what they think may happen to your child. Some children will have other conditions that are just as important to your child's future as infantile spasms. But in the UK, look at www.epilepsyaction.org which is the website of the British Epilepsy Association.