



# Hormones and Me Craniopharyngioma

## **Table of Contents**

About this Book	2
Introduction	4
What is a Craniopharyngioma?	5
A Little About the Brain	6
Symptoms	10
Diagnosis	13
Treatments Options	15
What Happens During Treatment?	21
Possible Complications and Their Treatments	22
Other Possible Longer–Term Problems	28
Additional Long–Term Follow–Up	31
Questions and Answers	33
Glossary	35
Support Organisations and Further Reading	40
References for Text	41
Hormones and Me Booklet Series	42

### About this book

This booklet, *Craniopharyngioma*, aims to give you a basic understanding of how a craniopharyngioma is diagnosed, the types of treatment available and the sorts of problems you may encounter. It has been written to give you a brief overview of the condition and not all of the information provided will be relevant to everyone with a craniopharyngioma.

We encourage you to discuss any additional questions or areas of concern with your doctor after reading this booklet.

Merck is proud to bring you this booklet from the *Hormones and Me* educational series. We hope that you find it a valuable and helpful resource.

This booklet was revised in 2024 with the help of Dr Craig Jefferies, Dr Rachel Debono and Dr Shubha Srinivasan, Paediatric Endocrinologists and members of the Australia and New Zealand Society for Paediatric Endocrinology and Diabetes (ANZSPED), previously APEG.

Prof Margaret Zacharin undertook final editing on behalf of ANZSPED.

Previous revisions of this booklet were created with the help of Dr Shubha Srinivasan (The Children's Hospital at Westmead, NSW Australia) and Dr Jim Penfold, (Women's and Children's Hospital, SA, Australia).

Special thanks to the original authors and editors, Dr Catherine DeVile (Great Ormond Street Hospital for Children, UK), Dr Richard Stanhope (Great Ormond Street Hospital for Children and the Middlesex Hospital, UK), Mrs Vreli Fry (Child Growth Foundation, UK), Ms Janis Clayton (Serono Laboratories (UK) Ltd, UK) and the British Society of Paediatric Endocrinology (BSPE).

### Introduction

A craniopharyngioma is a rare form of brain tumour. This particular type of tumour is present from before birth. It may grow fast or slowly and might cause problems in childhood or not until later in adulthood.

A tumour is a collection of cells that are growing abnormally. Craniopharyngiomas are benign tumours, which means they do not spread to other parts of the body. However, as they enlarge they may push on other sensitive areas of the brain which can cause problems. This includes affecting the pituitary gland which makes hormones that control many body functions and other nearby structures in the brain.

Craniopharyngiomas have now been associated with 2 gene mutations: CTNNB1 gene mutation is seen in the adamantinomatous form in childhood and adolescence. Surgery remains the first option for treatment however as more is being learnt about the process involved in their growth, newer treatments are emerging.

BRAF V600E mutations are seen with the papillary form in some adult craniopharyngiomas These tumours are amenable to treatment with a form of modern chemotherapy.

Although craniopharyngiomas are uncommon they account for around 9% of all brain tumours in children. This booklet focuses on childhood craniopharyngiomas, but some of the information is also relevant to adults with this condition.

Craniopharyngiomas are a rare type, but they are one of the most common types of childhood brain tumours. Craniopharyngiomas are NOT cancerous and will NOT spread to other parts of the body.

## What is a Craniopharyngioma?

A craniopharyngioma is a tumour that forms in the brain close to the hypothalamus and pituitary gland (diagram 1). It is thought to form early in the developing baby when it is still in the womb. No one knows why this happens, but it is not thought to be linked to taking medications or being ill during pregnancy. The condition is not hereditary so is not passed on from parents or grandparents.

The tumour is made up of solid parts and cysts which are filled with a thick fluid. Occasionally, a craniopharyngioma may be entirely fluid–filled or more rarely, completely solid.

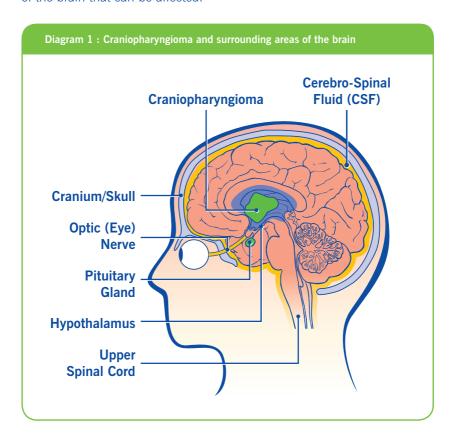
Although present from birth, the impact of a craniopharyngioma may be felt at any age – from birth to old age. Symptoms start to appear when there has been a change in the size of the tumour and it begins to press against other areas of the brain. The most common of these 'pressure' symptoms are headaches and disturbed vision.

## "Symptoms, treatment and outcomes will vary from person to person."

Children are more commonly diagnosed with a craniopharyngioma between the ages of  $5{\text -}10$  years although they may present at any age. They are slightly more common in boys than girls.

#### A Little About the Brain ...

When a person has a craniopharyngioma many of the symptoms will be related to the pressure the growing tumour puts on the delicate surrounding areas of the brain. To help you understand why these symptoms occur it is useful to know a little more about the different parts of the brain that can be affected.



#### **Hypothalamus**

The hypothalamus is a very important part of the brain that controls many essential body functions including:

- · body temperature
- hunger and thirst
- sleep
- · emotional behaviour
- · memory.

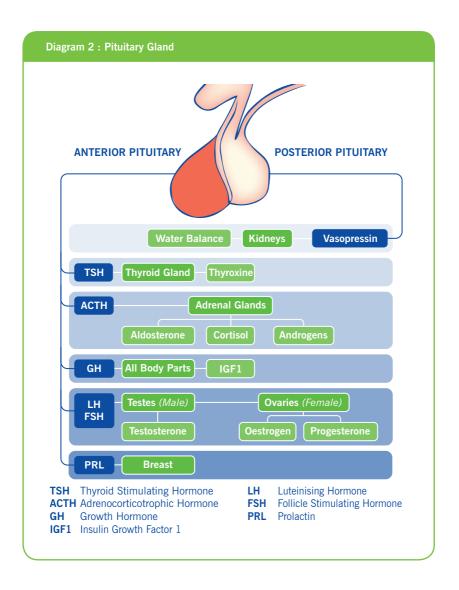
The hypothalamus is also the main 'communication centre' for the pituitary gland. It produces chemical 'signals' or hormones that travel via the bloodstream to the pituitary gland. These 'signals' then control the production and release of further hormones from the pituitary gland, which in turn control other glands and organs around the body.

#### **Pituitary Gland**

The pituitary gland is linked to the hypothalamus by the pituitary stalk. It is about the size of a pea and is divided into two lobes – the anterior (front) and posterior (rear) lobes. These lobes produce different hormones that control many important functions and other organs around the body including:

- growth
- · development in puberty
- stimulation of the thyroid gland
- stimulation of the adrenal glands for a normal response to stress
- fluid regulation.

The different hormones released by the pituitary gland and their target organs are summarised in diagram 2.



#### **Optic Nerves**

Optic nerves form the connection between our eyes and our brain. They carry all the important visual information from the back of the eye (retina) to the visual centres of the brain. The two optic nerves (one from each eye) cross over each other at a point in the brain just above the pituitary gland (optic chiasm).

#### Ventricles of the Brain

Ventricles are spaces inside the brain containing a constantly circulating fluid known as cerebrospinal fluid (CSF). The CSF flows through the ventricles via channels and openings, circulates over the surface of the brain and eventually drains back into the blood–stream.

## **Symptoms**

Symptoms produced by a craniopharyngioma vary depending on the tumour's size and location and the amount of pressure it is exerting on the surrounding structures.

Common symptoms include:

#### Headaches

Increased pressure from the tumour can cause the fluid channels to become blocked. The circulating CSF cannot escape and accumulates, resulting in a condition known as hydrocephalus ('water on the brain'). The symptoms of hydrocephalus are headaches and vomiting particularly first thing in the morning or at night.

#### Visual Problems

Vision can be affected if the craniopharyngioma is close to the optic nerves or the optic chiasm. Pressure on the nerves can stop signals from the eyes reaching the brain leading to vision loss.

Loss of eyesight is usually first noticed at the outer edges of vision, on one or both sides. If the problem is not picked up early it can eventually affect the whole field of vision. The early signs of loss of eyesight are frequently missed in children because a child can compensate by moving their head from side to side and do not notice.

#### Effects on Hormone Secretion

The growing tumour can affect the pituitary gland, the hypothalamus or the connection between them. When this happens the production and release of the pituitary hormones is disrupted and the following problems may occur:

#### **Poor Growth**

Poor growth or slowing growth rate in children can be a problem if not enough growth hormone (GH) is produced by the pituitary gland.

#### **Delayed Onset of Puberty**

The changes that occur in the body at puberty are triggered by the gonadotrophin hormones. These changes will not occur if insufficient levels of these hormones are produced by the body.

#### **Early Onset of Puberty (Precocious Puberty)**

Very occasionally the growth of a craniopharyngioma can affect the hypothalamus or pituitary gland in such a way that puberty is triggered early.

#### **Increased Thirst and More Frequent Urination**

Sometimes a craniopharyngioma can cause pressure on the hypothalamus and the posterior (rear) lobe of the pituitary gland or the pituitary stalk. This prevents the production of the hormone vasopressin (also called anti–diuretic hormone (ADH)) which helps control water loss from the body. When this happens excessive amounts of urine are produced along with an increased thirst – causing some children to drink up to 6–10 litres of fluid per day. This condition is called diabetes insipidus (more information on this condition is available in the Diabetes Insipidus booklet from the Hormones and Me series).

#### Other symptoms may include:

- · tiredness and frequent infections which are difficult to 'shake off'
- intolerance to cold temperatures
- disturbed sleep either excessive sleepiness during the day–time or increased waking at night
- weight loss or gain with a normal, decreased or increased appetite
- behavioural problems such as becoming withdrawn, introverted, aggressive or having poor concentration
- poor balance or weakness in the arms or legs
- fits though these rare.

Many of these symptoms can be caused by other conditions and it is important to get any symptom checked by your doctor.

## **Diagnosis**

If your doctor suspects a craniopharyngioma to be present a combination of checks and tests will be ordered to confirm the diagnosis and exclude other possibilities. These investigations may include:

#### Imaging to Locate the Tumour

#### **Brain Scans**

CT and MRI scans of the head are commonly used to confirm if a tumour is present. These scans allow the brain to be seen in great detail and are used to 'see' where the tumour is located and which of the surrounding structures are affected. Information from these scans allows treatment, especially surgery, to be planned very carefully.

#### Tests That Form Part of the Overall Assessment

#### Visual Assessment

An eye specialist will check to see if the tumour has affected the child's sight. They will check the child's field of vision by looking at the total area in which objects can be seen, both in front of them (central vision) and to the sides (peripheral vision).

#### Height & Weight

The height and weight of the child will be measured to check if growth has been affected. The child's stage of development in puberty will also be checked when appropriate. If growth records are available they are very useful, to help define whether and when there may have been a sudden change in growth pattern.

#### **Blood Tests**

Blood tests will be carried out to check for any unusual levels of hormones or side effects of abnormal levels.

## Hormones and Me Craniopharyngioma

#### **Water Balance**

If your doctor suspects your child has diabetes insipidus they may ask you to estimate how much fluid he or she drinks and urinates each day, and whether this has changed recently. If there are concerns, further tests may be done comparing the salt concentration in the child's blood and the salt concentration in their urine.

#### **Psychological Assessment**

It may also be necessary to assess the child's stage of learning, memory and behaviour as these can be affected by the tumour and some treatments.

## **Treatment Options**

Usually treatments will involve a combination of surgery, radiotherapy, and medications that help control symptoms. The types of treatments used will depend on the tumour's location and size, as well as the age and health of the child.

Your doctor will discuss the treatment options available to you. However, most patients with craniopharyngiomas will need surgery. It is important to understand that a craniopharyngioma is not a malignant tumour although it can invade local areas nearby. Attempted total removal may sometimes cause harm to these areas. It is sometimes preferable to use a combination of cyst drainage, part removal and radiotherapy as a combined way of achieving long term control of the craniopharyngioma. See the following describing each option.

#### Surgery

Craniopharyngiomas can be very 'sticky' and they can become attached to surrounding tissues. Removing the entire tumour without causing additional damage to other parts of the brain can therefore be difficult. The surgeon will decide whether it is best to try and completely remove the tumour or only partially remove it.

Sometimes a craniopharyngioma may regrow after surgery and further treatments will be needed. Surgery can be followed by radiotherapy treatment to help prevent this regrowth, but this will depend on the age of the child.

## Different types of surgical procedures include: Craniotomy

The most common form of surgery used to remove all or part of a craniopharyngioma is a craniotomy. This is a major operation that involves temporarily removing a piece of the skull in order to reach the area of the brain where the tumour is situated, so the tumour can be removed.

#### Trans-Nasal (or Trans-sphenoidal) Operation

If the tumour is small and confined to the area around the pituitary gland the operation can be done through the nose (trans–nasal). It may not be possible for this operation to be performed in all children. For example, the technique is not suited to very large tumours or a tumour in a small child (due to the inability to access the pituitary area because the sinuses are more solid without air pockets in a child below age 8-9 years).

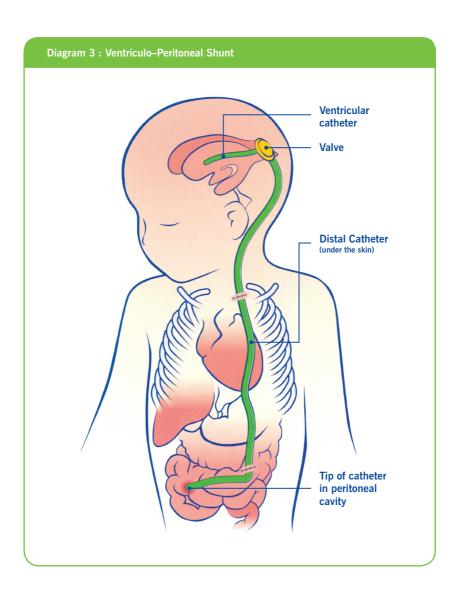
#### **Cyst Aspiration**

Cyst aspiration is a procedure that drains fluid from cysts that may form part of the craniopharyngioma. There may be a single cyst or several cysts that join together and press against a critical structure, causing increased pressure within the brain. A surgeon may decide to drain or aspirate the contents of a cyst before attempting to remove the tumour.

#### **Drainage of the Ventricles**

A craniopharyngioma can cause the ventricles of the brain to become enlarged due to the build—up of CSF. This happens in about one third to a half of the children with this type of tumour. It may be necessary to drain the CSF to reduce the pressure and re—establish the flow of fluid around the brain before removing the tumour.

The fluid is drained by inserting a temporary (or sometimes permanent) drainage system into the ventricles. The most commonly used system is called a ventriculo–peritoneal shunt and is shown in diagram 3. It consists of a tube (or shunt), that connects a ventricle to the abdomen so that the fluid can be safely drained away. The shunt has a valve so that the speed and pressure at which the fluid drains can be controlled.



#### Radiotherapy

Radiotherapy is used to target and kill tumour cells while leaving the surrounding normal tissues relatively undamaged. Although this form of treatment is more commonly used to treat malignant or cancerous types of tumours, it has been found to be effective in preventing regrowth of craniopharyngiomas.

Radiotherapy is mainly used when only part of the tumour can be removed. A course of radiotherapy can be given as soon as the child has recovered from surgery. Alternatively, a 'watch and see' policy may be adopted. With the option of having the radiotherapy at a later date if scans show that the craniopharyngioma is regrowing. If the surgeon is confident that the entire tumour has been removed and this is confirmed by further brain scans, then it is unlikely that radiotherapy will be needed.

Radiotherapy is not generally given to a child under 2 years of age and only rarely used for those under 5 years. This is because of the potential long—term effects radiation can have on development of young children, particularly in the area of memory processing.

Newer, more refined techniques of giving radiotherapy that produce fewer side—effects are being developed all the time – so this form of treatment may become more common. Options such as proton therapy exist but are not readily available in Australia and New Zealand.

Local radiation using a radioactive compound inserted into the cyst has been used successfully in some cases.

## Hormones and Me Craniopharyngioma

#### Chemotherapy

Chemotherapy is a treatment that uses anti–cancer drugs to stop the growth of tumour cells. It is not currently used to treat childhood craniopharyngiomas.

There is increasing understanding of the pathways involved in the growth of craniopharyngiomas which mean that targeted drugs are now being investigated in clinical trials.

## What Happens During Treatment?

The length of stay in hospital will vary depending on the child and what investigations and treatments they are having.

The operation to remove a tumour may be delayed (by a few days or occasionally a few weeks) if a shunt or cyst aspiration is needed.

Usually the child will be in hospital for up to 1 week after the operation. Longer hospital stays may be necessary depending on the individual, the procedures used and whether any new problems develop after surgery.

It is important to monitor the child's recovery after surgery. The child will be closely observed over the first 24–48 hours following surgery and may be taken to an Intensive Care Unit for careful observation.

Once the child has recovered from surgery any additional treatments, such as radiotherapy, can be organised. Radiotherapy, if needed, will be planned with radiotherapy specialists.

## Possible Complications and Other Treatments

A craniopharyngioma occurs in the part of the brain which is very close to the hypothalamus and the pituitary gland. Most of the problems experienced by patients are caused by damage to these very important areas.

#### **Diabetes Insipidus**

When the tumour is removed the pituitary stalk may be cut, stretched or damaged and the communication system between the hypothalamus and the pituitary gland is disrupted. This means the pituitary hormones, including vasopressin, may not be produced.

If vasopressin is not produced, or not enough of the hormone is released, then the body can not maintain its normal fluid balance. This condition is called diabetes insipidus and it is a common problem immediately or in the first few days after surgery. It is therefore very important to closely monitor the child's fluid intake and output as well as blood and urine samples during and after an operation.

A very young child with diabetes insipidus is not able to explain how thirsty he or she is and thus there is a risk of becoming rapidly dehydrated without correct monitoring and treatment.

Diabetes insipidus is not related to diabetes mellitus a condition involving high blood sugar levels.

#### How is Diabetes Insipidus Treated?

(For more detailed information, see the Diabetes Insipidus booklet) Diabetes insipidus is treated by replacing the missing hormone, vasopressin, with a similar but synthetic medication, called an 'analogue'. The vasopressin analogue has the same actions as the original hormone, but lasts longer and only has to be given 2 to 3 times per day. It is commonly given in the form of tablets, but can also be given as a nasal spray or injection.

In the first few days following surgery fluid balance may fluctuate and the child may have periods of feeling very thirsty and wanting to drink frequently. During this period the hormone may need to be given by an intravenous drip. Usually these problems settle down after a few days and the vasopressin, if still required, can be given orally or nasally.

Very occasionally a patient may have damage to the 'thirst centre' as well as having diabetes insipidus. This means that although a lot of fluid is lost the child does not feel thirsty (adipsia), and can quickly become dehydrated. If this happens the specialist will advise you on how much fluid the child needs to take each day.

Diabetes insipidus is not always permanent. Sometimes diabetes insipidus can occur in the first few days after surgery and then disappear completely. Occasionally there can be a 'three phase' response where diabetes insipidus occurs immediately after surgery, gets better 7–10 days later and then recurs about 2 weeks after the operation.

You will usually find out if a child will need to have long—term vasopressin treatment in the first few weeks after surgery.

#### **Anticonvulsants**

Convulsions or fits are rare in children with a craniopharyngioma. However, a child who has had a fit will be treated, with tablets known as anticonvulsants, to prevent any further fits occurring when the tumour is removed.

#### **Steroids**

Steroids are always given before and after surgery. There are two main reasons for this:

- 1. To help reduce the swelling and build—up of pressure within the brain.
- 2. To help the child cope with stress.

Adrenocorticotrophin (ACTH) is one of the hormones produced by the pituitary gland. It triggers the adrenal glands to make and release a steroid called cortisol. Cortisol is a 'fight and flight' hormone that enables us to cope with stresses such as illness and trauma.

If the pituitary gland and pituitary stalk are damaged, either by the craniopharyngioma itself or the surgery, then the ability to produce cortisol can be lost. The body will then be unable to cope with the stress of an operation unless replacement steroids are given.

Cortisol is initially given in high doses for the first few days following the operation, partly for stress and partly to reduce local swelling around the operation site. The dose is then gradually reduced until further tests of the pituitary gland function can be carried out.

#### Other Hormone Replacement

Once the tumour has been removed it is important to find out how well the pituitary gland is functioning. Approximately 2–3 months after the operation a series of blood tests will be done to find out which of the various pituitary gland hormones may be affected. The results from these tests will indicate which hormones need to be replaced. Patients who need treatment at this stage will normally need to take these replacement hormones for the rest of their lives.

Hormones that may need to be replaced include:

#### **Thyroid Hormone (Thyroxine)**

Thyroid stimulating hormone (TSH) is produced by the pituitary gland and stimulates the thyroid gland to produce thyroid hormone (a hormone that helps regulate the body's metabolism). Replacement thyroid hormone treatment is given in the form of tablets.

#### **Growth Hormone (GH)**

GH replacement treatment may be needed if the child is growing poorly. Occasionally, after surgery a child continues to grow normally despite a lack of growth hormone and growth hormone may still be given for other metabolic benefits.

GH treatment is given by injection and the dose calculated according to the size of the child.

Growth hormone is now approved in Australia for adults with a proven growth hormone deficiency.

## Hormones and Me Craniopharyngioma

#### **Sex Hormones**

Gonadotrophins are pituitary hormones that stimulate the gonads (ovaries in girls, testes in boys) to produce sex hormones (oestrogen and testosterone) needed to trigger the physical changes that occur during puberty.

If not enough of these hormones are being produced at the appropriate time then hormone replacement treatment will be needed to start and to continue puberty. Long-term maintenance of normal adult sex hormone levels may be required.

#### Multiple Pituitary Hormone Deficiency (MPHD)

MPHD or panhypopituitarism, is used to describe a situation where several pituitary hormones are affected. Children can develop MPHD after surgery or the pituitary gland may gradually stop producing hormones over time (particularly if radiotherapy has been used). Careful follow—up is therefore always required by a hormone specialist (endocrinologist) and these checks will need to be continued on into adult life.

#### IT IS VERY IMPORTANT TO REMEMBER:

- **1.** Medications MUST always be taken as prescribed. Do NOT run out of supplies.
- **2.** Hydrocortisone is VITAL in helping the body cope with stress. At times of illness, the prescribed dose will need to be INCREASED and if vomiting occurs, the hydrocortisone will need to be given by injection.
- **3.** Children who are deficient in pituitary hormones and/or who suffer with fits, for whatever reason, should wear an identity necklet or bracelet and carry a medical card.

## Other Possible Longer–Term Problems

When a craniopharyngioma is first diagnosed it may be quite large and might press against the hypothalamus and other brain structures. This can result in changes in the child's development and behaviour including altered growth, eating and sleeping patterns.

Neurosurgeons aim to cause as little damage as possible when they remove a tumour of this type – even if it means leaving a small amount behind. Some damage, however, may still occur during surgery and this can also lead to long–term problems. These problems may sometimes improve over time.

#### Increased Food Intake and Excess Weight Gain

Excessive weight gain may result from damage to the hypothalamus and its hormones. The 'eating control' centre is disrupted causing a persistent feeling of hunger, so that the child feels hungry even immediately after a meal. This change in eating behaviour can eventually cause children to become overweight if not managed carefully.

Increased appetite can develop very soon after surgery and the child can become totally preoccupied with thoughts of food. This may cause distress to the child and family. It is important to discuss the issue openly and to encourage the involvement of the child as much as possible in the ideas of how to deal with this problem. Early referral to a dietitian and talking to a psychologist can be helpful.

#### Sleep Disturbance

Sleep disturbance can be caused by a large tumour pressing on other areas of the brain or via damage during surgery. A child may wake up several times during the night or fall asleep at odd times during the day. The problem may continue as the child gets older.

The main concerns associated these altered sleeping patterns is the impact on the child's education (they may be very tired when they are at school) and the disturbance to other members of the family, particularly if the night–time wakefulness is spent looking for food. Daytime sleepiness can be treated effectively in some children with an amphetamine derivative.

#### **Impaired Thirst**

Although rare, the inability to feel thirsty is a serious problem that can sometimes occur when a child's hypothalamus is damaged. It is particularly serious when it is associated with diabetes insipidus. If both conditions are present, carers need to use a 'fluid prescription' with accurate daily measurements of fluid intake and variations in volume depending on the weather.

#### Memory Disturbance

Memory may be affected either by damage to the hypothalamus or disturbance to other nearby areas of the brain. The type of memory loss will vary from child to child, but short–term memory is usually affected rather than long–term memory.

Memory 'processing' can become a problem for some children. This is where new information is stored briefly but cannot be transferred in to the long–term memory. This may cause problems at school, especially high school, where learning in some subjects, such as mathematics, builds on previously learned information. This problem needs to be recognised early, so the child or teenager can be helped or they can choose appropriate subjects where this type of learning is not so important. Amphetamine derivatives can be helpful at reducing the impact of this problem.

#### Impaired Temperature Regulation

This is a rare but serious problem. Family and friends may notice that the child is not sensitive to temperature extremes and has difficulty maintaining a normal body temperature.

The problem requires very careful management, particularly in hot or very cold weather. It may be necessary to keep the child in an area with reasonably constant temperature when the outside weather is extreme especially if the child has impaired thirst as well.

#### **Mood Swings**

Children treated for a craniopharyngioma occasionally have mood swings which are quite out of character. This may be due to the fact that they have been ill or have damage to the hypothalamus. In some cases it may be necessary to seek counseling.

#### Metabolic Syndrome and Cardiovascular Problems Later in Life

Metabolic syndrome is a collection of disorders, including weight gain, high insulin levels and high cholesterol, that increase the chance of developing diabetes, high blood pressure, heart disease and stroke in later life. Craniopharyngioma patients can have many of the risks factors for metabolic syndrome. It is therefore very important to monitor these risk factors and treat these conditions if they arise.

## Additional Long-Term Follow-Up

#### Eyes

Eye sight problems often improve after surgery and may even return to normal. However, sometimes visual loss can become permanent. Eye tests will be needed at regular intervals to monitor progress. Special help may also need to be organised at school if the child's sight is very restricted in one or both eyes.

#### **Brain Scans**

A brain scan will usually be performed within 24–48 hours of surgery or before the child is discharged from hospital to make sure all is well. A repeat scan will probably be arranged 6 months after the operation to check for any regrowth. Depending on the results of this, scans will be repeated every 6–12 months for the next 2–3 years and then as recommended by the specialist.

#### **School Progress**

Some children may experience some learning difficulties following treatment of a craniopharyngioma. It is very important to monitor the child's progress at school and to provide extra assistance if a problem is recognised.

#### Problems may include:

- difficulty in catching up on missed school work
- · difficulties keeping up due to poor sight
- difficulties with concentration because the child is distracted by thoughts of food
- difficulties due to learning or memory problems.

## Hormones and Me Craniopharyngioma

Ideally, a psychologist should be involved early on in the child's care so learning and memory testing can be done at intervals after the operation or any radiotherapy treatment. Any special needs can then be picked up early and prompt referral can be made to an educational psychologist so that appropriate support and supervision can be organised at school as soon as possible. Rarely the child's needs may be better met in schools geared to special educational aspects and it is crucial not to let children struggle for several years before finding this out.

### **Questions and Answers**

#### Will the craniopharyngioma regrow?

There is a possibility that the craniopharyngioma will regrow. This is why it is important to have regular brain scans after the initial treatment. If it was not possible to remove the entire tumour then the chances of regrowth are increased.

#### What happens if the tumour regrows?

Treatment options will depend on the individual child. Radiotherapy is sometimes used. Further surgery may also be necessary.

#### Will a child's brothers and sisters have the condition as well?

This is unlikely. Craniopharyngiomas are not hereditary (not passed on from one generation to the next). They happen by chance as a result of a problem that occurs in the developing unborn child.

## What will happen when a child treated for a craniopharyngioma becomes an adult?

Most of the hormone treatments a child receives will need to be continued into adulthood. Some hormone deficiencies may also develop later and it is very important that the child is referred on to an adult endocrinologist in their mid to late teens for continued ongoing care.

#### Will the child be able to have children when they grow up?

Yes. Some will need hormone replacement therapy (testosterone or oestrogens) in order to go through puberty normally and will need to stay on this treatment to maintain sexual development.

Fertility treatment may be needed, and can be discussed with an endocrinologist and fertility specialist when the time comes.

## Hormones and Me Craniopharyngioma

#### Why is this tumour different in adults?

Craniopharyngiomas that occur in adults tend to have a different structure compared to those found in children. Childhood craniopharyngiomas can be more difficult to treat because they are growing faster – especially the ones that cause symptoms in children at a very young age.

## **Glossary**

#### **Cerebrospinal Fluid (CSF)**

The fluid, which flows through the ventricles and over the surface of the brain, eventually draining into the blood–stream.

#### Chemotherapy

Medications used to treat various forms of cancers or tumours.

#### **Computerised Tomography (CT Scan)**

A type of X–ray which shows a three dimensional view of the area being examined.

#### Congenital

A feature or condition that is present from birth, but not necessarily hereditary.

#### Convulsion

Involuntary muscular contractions and relaxations, also known as a fit.

#### Cortisol

A steroid hormone produced by the adrenal cortex. There are a number of hormones made by the adrenal gland and they are called corticosteroids.

#### **Dehydrated**

Condition resulting from excessive fluid loss by the body, i.e. when fluid intake fails to replace fluid lost by the body.

#### **Dietician/Nutritionist**

A health professional who specialises in dietary advice.

#### **Endocrine Gland**

A gland that makes hormones and releases them into the blood. The pituitary, thyroid, adrenal, testes (testicles) and ovaries are all endocrine glands. All of the glands together make up what is termed the endocrine system.

#### **Endocrinologist**

A doctor who specialises in the disorders of the endocrine glands.

#### **Gonadotrophins**

The sex hormones, i.e. follicle stimulating hormone (FSH) and luteinising hormone (LH).

#### Gonads

A term that refers to the sex glands, the ovaries in females and the testes in males.

#### **Growth Hormone (GH)**

A hormone released by the pituitary gland, which promotes growth.

#### Hereditary

When a genetic characteristic is passed on from parents to their children.

#### **Hormones**

Blood chemicals that stimulate growth and sexual development and help to regulate the body's metabolism. Hormones are produced by endocrine glands and carry messages from one cell to another via the bloodstream. Normally the body carefully controls the release of hormones as too much or too little may disrupt the body's delicate balance.

#### Hyperthermia

A term used to describe an unusually high fever, where body temperature is raised above normal.

#### **Hypothalamus**

Part of the base of the brain that controls the release of hormones from the pituitary gland.

#### Magnetic Resonance Imaging (MRI Scan)

A technique for obtaining high–resolution scans of the brain and other parts of the body. There is no exposure to X–rays and they can therefore be repeated in the same person many times.

#### **Nerves**

Transmit impulses from the brain to the rest of the body to make the body respond in a certain way.

#### Neurosurgeon

A doctor who specialises in surgery on the brain.

#### Oestrogen

A group of female hormones that are produced by the ovaries (from the onset of puberty until menopause) and which control female sexual development.

#### **Optic Chiasm**

The area just above the pituitary gland where the optic nerves from both eyes meet and cross one another.

#### **Paediatric Endocrinologist**

A doctor who specialises in the disorders of endocrine glands in children.

#### Pituitary gland

A pea-sized gland at the base of the brain, which releases a number of important hormones related to normal growth, development and fertility.

#### **Puberty**

Essentially the period in a young person's life, both male and female, where they become physically capable of reproduction.

#### **Subcutaneous Injection**

An injection given beneath the skin.

#### **Testosterone**

Most potent male sex hormone, which is produced in the testes (testicles) and controls male sexual development.

#### **Thyroid Gland**

A butterfly–shaped gland in the front of the neck below the larynx, which makes the hormone thyroxine.

#### **Tinnitus**

Constant ringing in the ears.

#### **Urinary Catheter**

A tube inserted into the bladder to remove urine from the body. It is used when the bladder is unable to function properly, or for a hospitalised patient who cannot leave their bed.

#### Womb

Uterus.

# Support Organisations and Further Reading

**Australian Pituitary Foundation** www.pituitary.asn.au

Australia and New Zealand Society for Paediatric Endocrinology and Diabetes (ANZSPED)

www.anzsped.org

The Endocrine Society

www.endocrine.org/patient-engagement

John Hopkins University (Information on Radiosurgery)

www.hopkinsmedicine.org/neurology-neurosurgery

**The Magic Foundation** 

www.magicfoundation.org

**Pituitary Foundation UK** 

www.pituitary.org.uk

**Pituitary Network Association (USA)** 

www.pituitary.org

**UK Child Growth Foundation** 

www.childgrowthfoundation.org

**UK Society for Endocrinology** 

www.endocrinology.org

### **References for Text**

Muller HL The Diagnosis and Treatment of Craniopharyngioma. Neuroendocrinology. 2020;110 (9-10):753-766

Otte A et al Childhood-onset Craniopharyngioma. J Clin Endocrinol Metab 2021 Sep 27;106 (10) e3820-e3836

Gan HW et al National UK guidelines for the management of paediatric craniopharyngiomas. Lancet Diabetes Endocrinol 2023 Sep;11(9): 694-706

Tang AR et al Global pediatric craniopharyngioma management modalities and outcomes. Childs Nerv Syst 2024 Jan;40(1):47-56

## Hormones and Me Craniopharyngioma

Merck is proud to bring you this booklet from the *Hormones and Me* educational series. We aim to provide readers with a better understanding of the issues relating to endocrine disorders particularly in children. We hope that you find it a valuable and helpful resource.

Please ask your doctor or nurse for further information on the resources available to you.

#### The **Hormones and Me** series includes:

Congenital Adrenal Hyperplasia (CAH)

Congenital Hypothyroidism

Craniopharyngioma

**Delayed Puberty** 

Diabetes Insipidus

Disorders of the Thyroid Gland in Children and Adolescents

Growth Problems in Children

Klinefelter Syndrome

Management of Emergency or 'Stress' Situations where Hypoglycaemia or Cortisol Deficiency Occur

Multiple Pituitary Hormone Deficiency (MPHD)

Prader Willi Syndrome

Puberty and its Problems

**Turner Syndrome** 

#### **DISCLAIMER**



#### Speak to an appropriate healthcare professional

The information contained in this booklet is intended for educational purposes only and should not be relied upon, or otherwise used, in place of medical advice.

The information contained in this booklet is not provided in the course of a professional relationship between healthcare provider and patient and it is not intended to create any patient relationship. Any medical information contained in this booklet is not intended as a substitute for informed medical advice. You should consult with an appropriate healthcare professional on (1) any specific problem or matter which is covered by information in this booklet before taking any action; or (2) for further information or to discuss any questions or concerns. You should never disregard medical advice or delay seeking the advice of a healthcare professional based on something you have read in this booklet. You fully understand and acknowledge that the information contained in the booklet is not intended or designed to diagnose, prevent, treat or provide a cure for any condition or disease, to ascertain the state of your health, or to be substituted for professional medical care. We encourage you to seek the advice of your healthcare professional if you have any questions or concerns arising from the information contained in the booklet.

The content of this booklet has been created by the members of the Australian and New Zealand Society for Paediatric Endocrinology and Diabetes (ANZSPED), without transfer of any value from Merck Healthcare Pty. Ltd. Merck Healthcare Pty. Ltd.'s participation is limited to: (i) granting of the right to use the Hormones and Me booklet in favor of ANZSPED; and (ii) sponsoring the editing of this booklet conducted by a third party vendor.

Whilst the parties have taken reasonable steps to ensure the accuracy of the contents of this booklet, it is provided on an "AS IS" basis and on the terms and understanding that Merck Healthcare Pty Ltd. (and their respective officers and employees) and all other persons involved in the writing, development, publication, distribution, sponsorship or endorsement of this booklet, to the fullest extent permitted by applicable law, are not responsible for (1) any error or any omission from this booklet; (2) make no warranties, representations or give any undertakings either express or implied about any of the content of this booklet (including, without limitation the timeliness, currency, accuracy, correctness, completeness or fitness for any particular purpose of the booklet or its content); (3) are not responsible for the results of any action or inaction taken on the basis of any information in this booklet; (4) are not engaged in rendering any medical, professional or other advice or services; (5) expressly disclaim any and all liability and responsibility to any person in respect of anything done by any such person in reliance, whether wholly or partially, upon the whole or any part of the contents of this booklet.

To the fullest extent permitted by applicable law, IN NO EVENT SHALL MERCK HEALTHCARE PTY LTD. BE LIABLE FOR PERSONAL INJURY, OR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGE WHATSOEVER AND HOWSOEVER ARISING, INCLUDING BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFITS ARISING OUT OF OR RELATED TO THE USE OF THE BOOKLET UNDER ALL HEADS OF LIABILITY (WHETHER IN CONTRACT, TORT OR OTHERWISE).

Merck Healthcare Pty Ltd. will not be held responsible for the content, accuracy or completeness of the information presented and the references and external third party website links contained in the booklet.

Merck Healthcare Pty Ltd | ABN 72 006 900 830 Suite 1 | Level 1 | Building B | 11 Talavera Road | Macquarie Park NSW 2113 | Australia

Phone: 1800 257 348

Date of preparation: March 2024 | AU-NONE-00034

© 2024 Merck KGaA, Darmstadt, Germany and/or its affiliates. All rights reserved. No part of this booklet may be reproduced in any form without prior consent.

### Hormones and Me Craniopharyngioma

This booklet is valuable reading for anyone with Craniopharyngioma.

It is also recommended reading for their family and friends.