AMEND is a charity registered in England and Wales (number 1099796). It provides support and information services to families around the world who are affected by multiple endocrine neoplasia and related endocrine tumours. AMEND encourages research into the conditions by awarding annual medical prizes and research awards. It hosts a patient information event every year and runs social media forums connecting patients from around the world.

Please visit our website for more information on AMEND or to make a donation: www.amend.org.uk

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What is Multiple Endocrine Neoplasia Type 1?

Multiple Endocrine Neoplasia Type 1 (MEN1), also known as Wermer's Syndrome, is one of a group of genetic disorders under the name Multiple Endocrine Neoplasia. The other MEN disorders are called MEN2a, MEN2b and FMTC (see separate books). They are inherited disorders, which can be passed down in families and which may cause more than one gland of the body’s endocrine (gland) system to develop growths. Some of the affected glands produce abnormally increased amounts of hormones, the body’s chemical messengers, which in turn cause a variety of different symptoms. Each type of growth may occur alone and independently of MEN.
How is MEN1 Diagnosed?

A diagnosis of MEN1 is made when either:
1. A patient has 2 or more MEN1-associated growths (see What Conditions are Associated with MEN1); or
2. A patient has only one growth, but there exists a family history of relatives with MEN1.

A patient may have the gene change that causes MEN1, but not have developed any of the growths. This patient may be called an "MEN1 carrier" and should be offered endocrine follow-up in clinic in the same way as a patient with the MEN1 growths.

What Conditions are Associated with MEN1?

There are three main types of growth associated with MEN1. These growths are often called tumours but are usually not malignant or cancer. They occur in the parathyroid glands in the neck, the endocrine pancreas and gut (duodenum) and the pituitary gland near the base of the brain behind the nose. The remainder of this information is divided up between these conditions and explains the current thinking on appropriate tests, treatment and medications.

80% (8 in 10) of MEN1 patients will have developed at least one of the growths by the age of 50, and around 40% (4 in 10) by the age of 20. Younger cases have been recorded. The condition varies greatly even within families; not everyone will have the same tumours and they will not occur at the same age.

Not all MEN1 patients will have all of the tumours detailed in this information. Initial screening for most of the tumours associated with MEN1 is the monitoring of hormone levels using blood tests and scans of the head, neck and abdominal area. This may lead to diagnosis of the growth, which may need surgical removal of just the growth or the whole of the affected gland.

Parathyroid Tumours

Growths in the parathyroid glands resulting in hyperparathyriodism (high level of parathyroid hormone - PTH) occur in more than 90% (9 out of 10) of MEN1 patients. The parathyroid glands lie just behind or are sometimes contained within the thyroid in the neck, although there are occasionally extra glands in the upper chest. The parathyroids are responsible for regulating the amount of calcium present in the body by releasing parathyroid hormone into the bloodstream. This helps to maintain the normal levels of calcium in the blood, bones and urine.

When growths develop within the parathyroid glands the body is fooled into releasing calcium from the bones into the
bloodstream and, if left untreated, can cause osteoporosis (brittle bones), so a bone density scan is sometimes recommended. Another problem associated with parathyroid growths is too much calcium in the urine, which may lead to kidney stones. Nowadays, however, most patients have very few of these symptoms, particularly when diagnosed and treated early.

Even a small rise in the body’s level of calcium can produce a wide range of symptoms (below):

### Symptoms of HYPERcalcaemia

<table>
<thead>
<tr>
<th>+ calcium</th>
<th>++ calcium</th>
<th>+++ calcium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thirst leading to excessive urination</strong></td>
<td><strong>Muscle weakness</strong></td>
<td><strong>Abdominal pain</strong></td>
</tr>
<tr>
<td>(at night)</td>
<td><strong>Constipation</strong></td>
<td><strong>Vomiting</strong></td>
</tr>
<tr>
<td><strong>Lethargy</strong></td>
<td><strong>Loss of appetite and nausea</strong></td>
<td><strong>Dehydration</strong></td>
</tr>
<tr>
<td><strong>Aches and pains</strong></td>
<td><strong>Fatigue</strong></td>
<td><strong>Lethargy</strong></td>
</tr>
<tr>
<td><strong>Indigestion</strong></td>
<td></td>
<td><strong>Abnormal heart rhythms</strong></td>
</tr>
<tr>
<td><strong>Depression</strong></td>
<td></td>
<td><strong>Coma</strong></td>
</tr>
<tr>
<td><strong>Mild memory impairment</strong></td>
<td></td>
<td><strong>Inflamed pancreas</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Bone pain</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Bone fractures</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Difficulty walking</strong></td>
</tr>
<tr>
<td>all of the previous plus:</td>
<td>all of the previous plus:</td>
<td>all of the previous plus:</td>
</tr>
<tr>
<td>• Muscle weakness</td>
<td>• Abdominal pain</td>
<td>• Inflamed pancreas</td>
</tr>
<tr>
<td>• Constipation</td>
<td>• Vomiting</td>
<td>• Bone pain</td>
</tr>
<tr>
<td>• Loss of appetite and nausea</td>
<td>• Dehydration</td>
<td>• Bone fractures</td>
</tr>
<tr>
<td>• Fatigue</td>
<td>• Lethargy</td>
<td>• Difficulty walking</td>
</tr>
</tbody>
</table>

Source: [www.patient.co.uk/doctor/hypercalcaemia.html](www.patient.co.uk/doctor/hypercalcaemia.html)

Testing for Parathyroid Tumours

**Blood Tests**

**Blood Calcium (serum calcium)**
A simple blood test (annual from age 5-10 years).

**Parathyroid Hormone (PTH)**
A simple blood test (annual from age 5-10 years).

**Scans**

**Sesta-MIBI of neck area** This scan may be performed, not to diagnose affected parathyroids, but to locate them before surgery. A Sesta-MIBI scan takes around 2 hours to perform. The radioactive Sesta-MIBI is injected into the patient where it is taken up by the affected gland(s). Pictures are taken of the area immediately after the injection, and then 1 hour 45 minutes to 2 hours later. The affected glands are those that are still lit up at the end of the scan.

**Ultrasound**
A painless scan of the neck area using a probe running over the skin.

Treating Parathyroid Tumours

Treatment is by surgical removal of the affected parathyroid gland(s). In MEN1, opinion varies as to whether to remove all four parathyroid glands even if they are not all affected, and at what stage of the disease to advise surgery, particularly for recurrent disease when not all glands were removed originally. Many surgeons perform a total parathyroidectomy (removal of all 4 glands at once) because it is more or less certain that all will eventually be affected and that this will save future surgery in the same area. Other surgeons believe that affected glands should be removed individually as and when a tumour arises (Partial Parathyroidectomy).

Many surgeons also perform a thymectomy (removal of the thymus gland in the upper chest) at the same time as total parathyroidectomy, since extra parathyroid glands may often be found in or around the thymus of someone with MEN1. Removal of the thymus may also reduce the risk of developing a thymic carcinoid (see Associated MEN1 Tumours).

At the time of a Total Parathyroidectomy, some surgeons choose to transplant part of a normal gland back into the body (usually into the neck or arm). This Parathyroid Transplant may help to control the body’s calcium levels, and if in time this gland develops a tumour itself, it may be easier to remove. In the event of Total Parathyroidectomy, the patient will need lifelong medication in the form of Vitamin D (see below) which helps the body to maintain a healthy level of calcium. Decisions regarding these issues will be discussed with you when you see your surgeon.
SURGERY
The surgeon makes a 4-5cm incision at the base of the neck through which the affected gland(s) are removed. It is usual for the patient to be up and about, eating and drinking the same or next day.

Hospital Stay
Usually a few days

Risks
The most common side effect of parathyroid surgery is treatable episodes of low calcium (hypocalcaemia), which requires immediate top-up replacement medication. There is also a possible but rare risk of nerve damage which might affect the voice. Often there are no obvious symptoms of very mild hypocalcaemia. Some signs that calcium levels may be low include (below):

<table>
<thead>
<tr>
<th>Symptoms of HYPOcalcaemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>- calcium</td>
</tr>
<tr>
<td>• Tingling of the face and extremities (fingers and toes)</td>
</tr>
<tr>
<td>• Pins and needles in the face and extremities (fingers and toes)</td>
</tr>
<tr>
<td>• These symptoms may be worse when crossing one’s legs or sitting on the toilet for example.</td>
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</tbody>
</table>

MEDICATION
Vitamin D
(alphacalcidol, calcitriol)
Vitamin D supplements in a capsule form, which aids absorption of calcium from the patient’s diet. Taken once a day, this is often the only life-long medication required after total parathyroidectomy.

Eating foods that are good sources of vitamin D and calcium is also helpful:
• Good sources of vitamin D include dairy products, eggs, oily fish such as salmon and sardines, and meats, particularly liver.
• Good sources of calcium include dairy products, green leafy vegetables, tofu, nuts, sardines and pilchards.

Calcium Carbonate
(Calcichew, Adcal)
This is a chalk-like tablet that has to be chewed or sucked. This is often used as a temporary calcium “top-up” after surgery, but is not necessarily required life-long. Too large a dose or an indication that this supplement is no longer needed may become apparent if the patient begins to suffer from headaches, nausea and vomiting.

Magnesium supplement
This may be in the form of an injection or a tablet (e.g. magnesium glycerol-phosphate), but is rarely needed long-term.
# Pituitary Tumours

The pituitary gland is located near the base of the brain, just above the brain’s hypothalamus. It secretes hormones that regulate growth, metabolism, and other bodily functions. A pituitary tumour is a growth (benign or malignant) in the pituitary gland. These tumours can affect the hormone production and secretion of the gland, leading to various symptoms and conditions.

## Types of Pituitary Tumours

<table>
<thead>
<tr>
<th>Type of Tumour</th>
<th>Hormone Overproduced or Deficiency</th>
<th>Possible Symptoms</th>
<th>Other Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolactinomas</td>
<td>Overproduces prolactin</td>
<td>Headaches, visual disturbances</td>
<td>-headache, visual disturbances</td>
</tr>
<tr>
<td>Somatotrophinoma</td>
<td>Overproduces growth hormone (GH)</td>
<td>Headaches, visual disturbances</td>
<td>-somatotrophinoma, growth hormone overproduction</td>
</tr>
<tr>
<td>ACTH-producing</td>
<td>Overproduces ACTH</td>
<td>Headaches, visual disturbances</td>
<td>ACTH overproduction, ACTH controls the production of cortisol</td>
</tr>
<tr>
<td>Non-functioning</td>
<td>Produces no obvious hormone</td>
<td>Headaches, visual disturbances</td>
<td>non-functioning tumour, no hormone overproduction</td>
</tr>
<tr>
<td>Microadenomas</td>
<td>Less than 10mm diameter</td>
<td>Headaches, visual disturbances</td>
<td>Microadenomas, less than 10mm</td>
</tr>
<tr>
<td>Macroadenomas</td>
<td>More than 10mm diameter</td>
<td>Headaches, visual disturbances</td>
<td>Macroadenomas, more than 10mm</td>
</tr>
</tbody>
</table>

## Possible Symptoms

- **Headaches**
- **Visual disturbances**
- **Women:** Lactation (breast milk production) without pregnancy, lack of periods, may lead to infertility
- **Men:** Erectile dysfunction and infertility
- **Causes a condition known as Acromegaly**
  - Characterized by changes in appearance such as a large jaw, increased size of hands and feet
  - Result of GH overproduction
  - Causes:
    - Increased size of hands and feet
    - Excessive growth of body hair
    - Changes in body shape
    - Increased risk of diabetes
- **Causes a condition known as Cushing’s Disease**
  - Characterized by:
    - Weight gain
    - Reddening of the face and neck
    - Excess growth of body and facial hair
    - Change in body shape
    - Raised blood pressure

## Other Information

- **Most common pituitary tumour:** Prostate
- **Somatotrophinoma:** The main hormone required for normal growth in childhood and adolescence
- **Macroadenomas:** May also cause headaches, visual disturbances

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The pituitary gland is a small but crucial part of the brain. It plays a vital role in regulating hormones that control growth, metabolism, and other bodily functions. Pituitary tumours can disrupt these processes, leading to various symptoms and conditions. Early detection and treatment are crucial for managing these tumours and their effects.
Testing for Pituitary Tumours

All forms of pituitary tumour may be found using an MRI or CT scan of the head.

PROLACTINOMAS

Blood Tests
Serum prolactin A simple blood test (annual from age 5-10 years)
Thyroid function (to exclude other causes of increased prolactin production) A simple blood test (annual from age 5-10 years).

Scans/Other
MRI/CT scan Annual or 3-yearly
Baseline pituitary scan Annual or 3-yearly.

Visual Field Examination Simple eye test performed if prolactinoma is detected.

SOMATOTROPHINOMAS
Tests performed if symptoms are present.

Blood Tests
IGF-1 (Insulin-Like Growth Factor-1) A simple blood test (if result is abnormally high, further tests are done, as below)

Serum Growth Hormone Day Curve Simple blood tests done over the course of a day
Oral glucose tolerance test Taking a drink of glucose followed by simple blood tests over 2-3 hours

Scans/Other
MRI/CT scan
Baseline pituitary scan

ACTH-PRODUCING
Tests performed if symptoms are present

Blood Tests
Dexamethasone suppression test (overnight or 2 days) Taking a steroid tablet or tablets followed by simple blood and/or urine tests

Scans/Other
MRI/CT scan of the pituitary, adrenals and lung/abdomen
Baseline pituitary scan
Chest x-ray
24 hour urine collections Simple collections of urine over the course of a day to measure cortisol levels.

Treating Pituitary Tumours

Treatment may be in the form of medicine or surgery. This will depend upon the type of growth and its size. Sometimes small growths can be treated with tablets or injections although often surgery is needed. In some cases (rarely) radiotherapy is needed.

PROLACTINOMAS
Medication called a dopamine agonist (eg bromocriptine – brand name, Parlodel; cabergoline – brand name, Dostinex; or quinagolide), to reduce the production of prolactin. Tablet doses vary according to the size of the tumour and the amount of prolactin it produces. In some cases surgery (transsphenoidal surgery), radiotherapy, or both may be needed.

SOMATOTROPHINOMAS
Treatment will depend upon the size of the tumour and the age of the patient. Surgical removal (transsphenoidal surgery) of the tumour is the most common treatment; however, radiotherapy either alone or after surgery may also be used in order to reduce GH levels. Treatment with injections of octreotide (Sandostatin) or Lanreotide (Somatuline) may also be helpful.

ACTH-PRODUCING
Surgical removal (transsphenoidal resection) of the tumour from the pituitary gland, followed by radiotherapy if this is not completely successful.
be treated using a drug called desmopressin. In rare instances, after treatment, some patients will require long-term medication to replace other hormones (such as sex hormones, thyroid hormone, or corticosteroids), or may require additional treatment in the form of radiotherapy, or a somatostatin analogue (e.g. Octreotide or Lanreotide).

**RADIOTHERAPY**

This may be used to reduce the size of a pituitary tumour that cannot be treated with medicines or approached surgically. Alternatively, it may be used after surgery to decrease the chance of the tumour re-growing. An MRI scan is used to plan the radiation field, and then the treatment is given by pointing the radiation beam via 3 targets to focus on the pituitary gland. This is quite painless, and is usually given for 5 days a week over 5 weeks, giving 25 treatments altogether. Each treatment is usually over in half an hour, and most patients can carry on their normal life throughout although they may tire more easily than usual.

**Pancreatic Islet Cell Tumours**

Tumours of the pancreatic islet cells occur in up to 75% (3 in 4) of MEN1 patients. The pancreas is responsible for producing juices (digestive enzymes) to aid food digestion. It also produces hormones to control blood sugar levels in the body which are important as the body’s main source of energy. Some hormones produced in the islet cells are:
- insulin, which lowers blood sugar levels;
- glucagon, which raises blood sugar levels;
- gastrin, which increases the amount of acid in the stomach and can produce ulcers; and
- somatostatin, which has affects on the release of growth hormone from the pituitary.

The tumours are usually multifocal (occur in clusters of more than one) and up to half have the tendency to become malignant if left untreated. The varied tumours occur in differing cells of structures within the pancreas called the Islets of Langerhans. About 10% (1 in 10) of MEN1 patients may experience more than one type of pancreatic tumour at one time. Most of these tumours will produce greater than normal amounts of hormones, however some may remain non-functioning. Pancreatic tumours in MEN1 are often referred to as Pancreatic Neuroendocrine Tumours (NETs).
### Testing for Pancreatic Tumours

Many pancreatic tumours, including non-functional adenomas, may be detected by a CT or MRI scan, although other types of imaging may be necessary if the tumours are very small. These include endoscopic ultrasound, where an ultrasound probe is passed down the throat to the gut (duodenum) on the end of a glass fibre cable, scanning with a radioactive form of somatostatin, or sampling from the veins of the liver while injecting tiny amounts of calcium into different arteries that supply the pancreas. In addition:

<table>
<thead>
<tr>
<th>TYPE OF TUMOUR</th>
<th>ACTION OF TUMOUR</th>
<th>POSSIBLE SYMPTOMS</th>
<th>OTHER INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrinomas</td>
<td>Overproduces the hormone gastrin</td>
<td>Stomach (peptic) ulcers and diarrhoea, sometimes referred to as Zollinger-Ellison syndrome.</td>
<td>Most common MEN1 pancreatic tumour. Gastrinomas can also occur in the foregut (duodenum).</td>
</tr>
<tr>
<td>Insulinomas</td>
<td>Overproduces the hormone insulin</td>
<td>Sweating and faintness due to low blood sugar levels.</td>
<td>Usually located in the tail (end) of the pancreas.</td>
</tr>
<tr>
<td>Glucagonomas</td>
<td>Overproduces the hormone glucagon</td>
<td>Skin rash and high blood sugar levels (hypoglycaemia).</td>
<td>Very rare tumour whose effects are referred to as being Verner-Morrison syndrome. Only reported in a few MEN1 patients.</td>
</tr>
<tr>
<td>VIPomas</td>
<td>Overproduces the pancreatic protein, vasoactive intestinal peptide</td>
<td>Severe diarrhoea</td>
<td></td>
</tr>
<tr>
<td>Somatostatinomas</td>
<td>Overproduces the hormone somatostatin which curbs the release and action of many hormones</td>
<td>Severe diarrhoea and formation of gallstones</td>
<td>Do not appear to overproduce any hormones.</td>
</tr>
<tr>
<td>Non-Functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**INSULINOMAS**

**Blood Tests**

**Fasting glucose** A simple blood test after an overnight fast (annual from age 5-10 years)

**Insulin** A simple blood test taken at the same time as the fasting glucose (annual from age 5-10 years).

**Scans/Other**

**Baseline scan** (annual or 3-yearly).

**OTHER TUMOURS**

**Blood Tests**

**Chromogranin A/ Proinsulin/ Glucagon**

Simple blood tests done after an overnight fast (annual from age 20 years).

**Scans/Other**

**MRI scan/CT scan/Octreotide scan** (annual or 3-yearly from age 20 years).

**Angiogram** Test done by radiologist to determine location of tumour and its blood supply.
**Treating Pancreatic Tumours**

In days gone by, removal of the whole stomach was the treatment of choice for gastrinomas. Fortunately, thanks to advances in medicine, this is no longer the case. Overall, the treatment of pancreatic tumours will depend upon the size and type of tumour, and where it is located on the pancreas.

**GASTRINOMAS**

Single gastrinomas may be removed by surgery; however, because they usually occur in clusters, opinion varies as to the effectiveness of surgery in this case. Indeed, the possible ulcers and diarrhoea caused by gastrinomas can be controlled in most patients using one of a number of anti-ulcer drugs called proton pump inhibitors (PPI), such as lansoprazole, and H2 blockers, such as cimetidine or ranitidine. Both types of drug aim to control the production of stomach acid, which reduces the symptoms of ulcers. The doses of PPIs used to control the effects of gastrinomas are often much higher than the doses used in other patients.

**INSULINOMAS**

Surgery is the main treatment in MEN1 patients with hypoglycaemia due to insulinoma, but, very occasionally, the drug diazoxide can be used if the tumour is difficult to find.

**OTHER (NON-FUNCTIONING) TUMOURS**

Surgery is the main treatment and is considered if and when a tumour grows to a maximum of 20mm in width.

**SURGERY AND MEDICATION**

**Pancreatic Enucleation**

This involves the removal of only the tumour itself by either laparoscopic (key-hole) or open surgery.

**Hospital Stay**

About 1 week.

**Recovery Time**

About 2-3 weeks depending on type of surgery.

**Risks**

Inflammation of the pancreas (pancreatitis) causing severe pain in the upper abdomen and back.

Leakage from the stump (pancreatic fistula) which may lengthen the hospital stay but does not usually require further surgery.

**Medication**

Some surgeons temporarily use octreotide treatment after surgery to reduce the risk of possible complications.

No medications long-term.

**Distal Pancreatectomy**

This involves the removal of the body and tail of the pancreas.

**Hospital Stay**

About 1 month.

**Recovery Time**

About 1 month.

**Risks**

Same as for pancreatic enucleation above. There is a risk that the spleen may have to be removed. If more than 80% of the pancreas is removed, diabetes may occur.

**Medication**

Pancreatic Enzymes taken with food to aid its digestion.

Insulin injections to replace the insulin normally secreted by the pancreas.

**Total Pancreatectomy**

This involves the complete removal of the entire pancreas as well as part of the duodenum and will definitely cause diabetes.

**Hospital Stay**

About 2 weeks.

**Recovery Time**

From 1-3 months.

**Risks**

As for pancreatic enucleation.

Risk of haemorrhage requiring blood transfusion.

**Medication**

Pancreatic Enzymes taken with food to aid its digestion.

Insulin injections to replace the insulin normally secreted by the pancreas.

**Treating Metastatic Pancreatic Tumours**

If MEN1 pancreatic tumours spread outside of the pancreas (metastatic disease) and can no longer be removed by surgery alone, doctors may try a variety of different therapies to control
the growth, spread and hormone secretion of the tumours. These may include injections of somatostatin analogues, reducing the tumour load in the liver (embolisation or ablation), combination chemotherapy, or radionuclide targeted therapy (Yttrium or Lutetium therapy).

Tumours in some patients may be suitable for treatment with one of two types of newer drug therapy that ‘switch off’ (inhibit) cell growth:

1. sunitinib malate (Sutent) – a tyrosine kinase inhibitor (TKR)
2. everolimus (Affinitor) – an mTOR inhibitor

These drugs are given as tablets and are not chemotherapy but may have significant side effects. You should discuss with your doctor the suitability of these treatments for you as well as the potential side effects.

The NET Patient Foundation (see useful organisations) is a great source of additional information on these therapies.

**Associated MEN1 Tumours**

MEN1 patients may develop carcinoid tumours in the chest or stomach area, lipomas (benign tumours of fat cells), benign thyroid tumours and benign tumours of the outer layer of the adrenal gland (adreno-cortical adenomas).

**CARCINOID TUMOURS**

Less than 5% (1 in 20) of MEN1 patients may experience a carcinoid tumour. These tumours overproduce the hormone serotonin, causing ‘asthma’, attacks of flushing and diarrhoea (Carcinoid Syndrome). Carcinoid tumours are often found in the area of the lungs, stomach or pancreas. Symptoms can be relieved in most patients using somatostatin analogues (e.g. Octreotide or Lanreotide). Surgery & radiotherapy (e.g. MIBG or chemotherapy) are also useful.

(See NET Patient Foundation in Other Useful Organisations).

The treatment for carcinoids of the middle gut is surgery or radionuclide therapy (MIBG or Octreotide) and/or therapies aimed directly at the liver such as embolisation or radiofrequency ablation. Carcinoid tumours of the islet cells of the pancreas may be treated in the same way, but often with chemotherapy as well. Carcinoids in the thymus gland at the top of the chest affect men and cause problems from local growth of the tumour rather than hormone production and are best treated by surgical removal.

**LIPOMAS**

A common benign tumour of fat cells which are commonly found in up to one in three MEN1 patients. If they are a problem, they can usually be removed by a simple operation under general or local anaesthetic.

**ADRENO-CORTICAL TUMOURS**

Benign tumours of the cortex (outer layer) of an adrenal gland which sit on top of each kidney and may overproduce cortisol. Cortisol is a hormone important in maintaining the water and mineral levels and thereby blood pressure in the body. These tumours produce a condition called Cushing’s syndrome, similar to that produced by ACTH-secreting tumours of the pituitary (see Pituitary Tumour – ACTH Tumour). Treatment is by removal of the affected adrenal gland, which can usually be done by key-hole (laparoscopic) surgery. If both adrenal glands are removed, a patient would need to take the same medication as someone with Addison’s Disease (see MEN2a booklet). In MEN1 these tumours may often be non-functional and usually do not need treatment.

**ANGIOFIBROMAS**

Small, benign, raised, red, spots on the face

**COLLAGENOMAS**

Small, benign, white, raised spots that may occur anywhere on the body.
Children and MEN1

Deciding to have children

There is a 50% (1 in 2) chance that a child born to a known MEN parent will also have MEN (see Genetic Testing Explained). If a child is known to carry the altered gene, testing and treatment programmes may be established from the outset, and conditions addressed and managed before serious symptoms develop. Ante-natal testing is available. Would-be mothers can be referred to one of the 23 UK clinical genetics centres before they become pregnant. However, since early treatment is available, antenatal testing would be a personal choice, often depending upon a patient's own experience with the disease.

Pregnant Mothers with MEN1

Management during pregnancy will depend upon the particular issues in each mother. The Obstetrician should be informed as soon as a pregnancy is confirmed.

DNA Testing for Children

Children of a MEN parent with a known gene change (mutation) can be offered a genetic test to determine if they also carry the gene. This is usually offered at an age when biochemical testing is started at around 5-10 years of age. You should discuss this with a genetic counsellor at a genetics services centre.

Treatment and Testing Recommendations

Recommended blood test programme for children with MEN1

Parathyroids

Calcium: Annual tests from ages 5 to 10 years

Parathyroid Hormone: Annual tests from ages 5 to 10 years

Pituitary

Prolactin: Annual test from ages 5-10 years

IGF-I: Annual test from ages 5-10 years

Opinion varies regarding the timing of surgery for MEN1 gene carriers who do not yet have symptoms. You should discuss testing and treatment in detail with a specialist doctor.

Blood Tests

There are many adults who find blood tests difficult, so no parent should be surprised if their child develops an intense dislike to them as well. For small children, many hospitals use Ametop or Emla Cream (“magic cream”) covered by plasters to numb the hands and/or arms ready for the tests. The cream takes up to an hour to work during which time the child may or may not focus on the area and possibly become distressed. In cases where a child regularly appears distressed, it is sometimes quicker and easier not to use the cream, or to use a topical anaesthetic spray instead. A phlebotomist experienced in doing children’s blood tests is a must to ensure as few repeated jabs and tests and thereby as little distress to the child as possible.

Genetic Testing Explained

Chromosomes and Genes

In each cell of the body there are 23 pairs of chromosomes that contain our genes. We inherit one chromosome from each pair from each parent. This means that we inherit one copy of each gene from each of our parents, thereby giving us two copies. In most people there are two normal functioning MEN1 genes. In patients with MEN1, one of this pair has a change (mutation). This can be inherited from either parent (inherited or familial) or can start in an individual for the first time (new mutation or sporadic). When someone with MEN1 has children they can pass on either the normal gene or the altered gene. This is entirely random, like tossing a coin. Each child therefore has a 1 in 2 or 50% chance of inheriting the altered gene (coloured blue, overleaf), and is therefore predisposed to the tumours of MEN1. This method of inheritance is called autosomal dominant inheritance.
**Genetic Testing**

It is possible in some families to have a genetic test to see whether someone has inherited the gene change. However, the first step is to have a blood sample tested from someone with MEN1 in the family. With this initial test (mutation screen), the result may not be received for a number of months, and, indeed, the gene change is not always found. If the gene change is found, a blood test (predictive genetic testing) may then be offered to other members of the family. The results from predictive genetic testing are received normally within several weeks. There are a number of issues surrounding predictive genetic testing particularly in relation to children and as such, all patients should be seen and counselled by a consultant clinical geneticist. If the gene fault cannot be found or if a blood sample from an affected person cannot be obtained then predictive genetic testing cannot be done.

Having children tested is a very individual decision, however; if children of a known MEN1 parent are tested, those unaffected can rest assured that no further investigations are required. Those who have inherited the gene can be comforted by the fact that testing and monitoring patterns will determine as early as possible when intervention is required. Thanks to this early detection by DNA test, complications from ulcers, kidney stones as a result of parathyroid tumours, and advanced pancreatic islet cell cancer, may be drastically reduced.

Genetic testing and counselling is available and a referral to a genetic centre is usually made through your GP or specialist.
Useful Information

FREE PRESCRIPTIONS: In the UK, if you are to take lifelong insulin for diabetes, you are entitled to free prescriptions for all medicines. You should obtain a P11 leaflet from your doctor and fill in form B. Your doctor will then sign it and send it on. You will then receive an exemption certificate, which you must show to your pharmacist when collecting medicines.

MEDICALERT®: AMEND recommends that anyone taking lifelong medications obtain and wear a MedicAlert® identification emblem. The emblem contains summarised information of your medical condition and a 24-hour Helpline number for emergency medical staff to call in order to obtain detailed information on your medical condition from the MedicAlert database. This enables emergency medical staff to give appropriate treatment in full knowledge of your underlying condition and current medications. Emblems come in a range of styles so that there is something for everyone, even children. Telephone AMEND for an order form and brochure or join online at www.medicalert.org.uk. Other medical identification products are available.

Useful Organisations

The Pituitary Foundation  
Tel: 0870 774 3355  
www.pituitary.org.uk

Diabetes UK  
Tel: 020 7424 1000  
www.diabetes.org.uk

NET Patient Foundation  
Tel: 0800 434 6476  
www.netpatientfoundation.org

The NET Patient Foundation is an excellent resource for more detailed information on pancreatic neuroendocrine tumours.

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AMEND would like to thank the following for their help and support in producing and updating this and all our other AMEND patient information titles:
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Afterword

This book has been written for MEN patients by MEN patients with the help of a medical advisory team. The aim of this book is to answer those questions, sometimes in great detail, that one may come across during a lifetime of living with MEN1. It is not for use in self-diagnosis. It contains detailed information on tests, surgery and potential symptoms associated with MEN1. However, it is possible that not all of this information will be relevant to you. This book is not intended to replace clinical care decisions and you should always discuss any concerns you have with your specialist. Every care has been taken to ensure that the information contained in this book is accurate, nevertheless, AMEND cannot accept responsibility for any clinical decisions.

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