MEN 1

Patient Information

Multiple Endocrine Neoplasia Type 1

AMEND

AMEND USA filed for its non-profit status in 02-13
and is affiliated with AMEND UK Charity

MEN SUPPORT

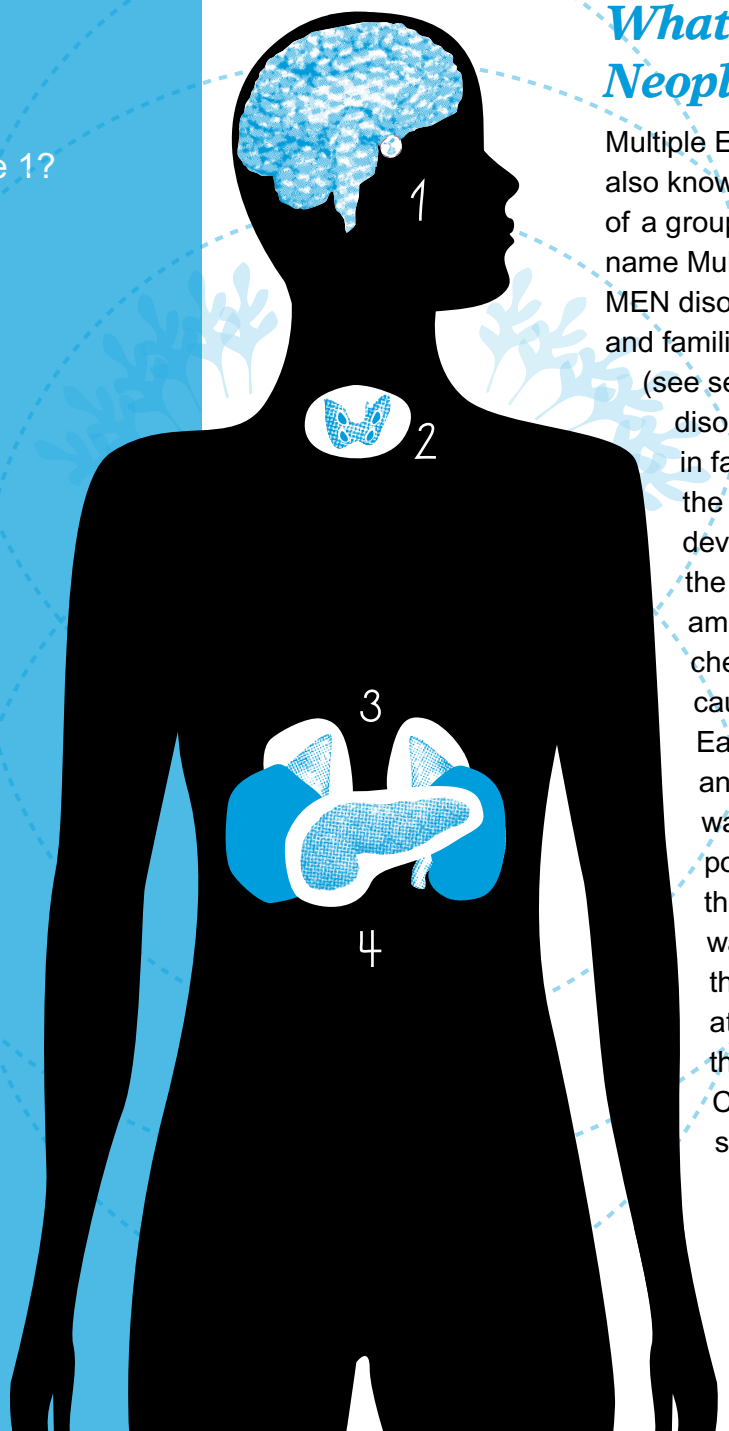
Tel: 707-464-7066 (PST)

Email: info@amendusa.org

www.amendusa.org

design by Up The Hill www.up-the-hill.co.uk

Contents



1 pituitary 2 parathyroid 3 adrenal glands 4 pancreas

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. Other MEN disorders are called MEN2a, MEN2b and familial medullary thyroid cancer or FMTC (see separate books). They are inherited disorders which can be passed down in families. MEN disorders may cause the body's endocrine (gland) system to develop abnormal growths. Some of the affected glands produce 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/or independently of MEN. MEN1 was first described in 1903. In 1954 the possibility that MEN1 was genetic and therefore inherited was realized, but it wasn't until 1997 that the actual gene that causes MEN1 was discovered at the National Institute of Health in the USA and also by the European Consortium on MEN1, and called simply the MEN1 gene.

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 is a family history of relatives with MEN1.
3. A patient has a positive genetic test for an abnormal MEN1 gene

A patient may have the gene change that causes MEN1, but have no associated growths or symptoms. 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 tumors, but are usually not malignant or cancerous. They mainly occur in the parathyroid glands in the neck, the endocrine pancreas and gut (duodenum) and the pituitary gland. The remainder of this information is divided up between these conditions and explains the current thinking on appropriate tests, treatment and medications.

Roughly 80% (8 in 10) of patients with MEN1 will develop 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 tumors and they will not occur at the same age. Not all MEN1 patients will have all of the tumors detailed in this information.

Initial screening for most of the tumors associated with MEN1 includes the monitoring of hormone levels using blood tests, as well as scans of the head, neck and abdominal area. If a growth is diagnosed, it may require surgical removal by itself or possibly with the entire affected gland.

Parathyroid Tumors

Growths in the parathyroid glands resulting in hyperparathyroidism (high level of parathyroid hormone - PTH) occur in more than 90% (9 in 10) of MEN1 patients. The parathyroid glands lie close to or within the thyroid in the neck. Occasionally, an individual may have extra parathyroid glands in the upper chest or at the base of the skull. 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. 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):

Testing for Parathyroid Tumors

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 that runs over the skin.

Presentation of Hypercalemia

+ calcium	++ calcium	+++ calcium
• Excessive urination or thirst • Indigestion • Depression • Mild memory impairment	all of the previous plus: • Muscle weakness • Constipation • Loss of appetite and nausea • Fatigue	all of the previous plus: • Abdominal pain • Vomiting • Dehydration • Lethargy • Abnormal heart rhythms • Coma • Inflamed pancreas

Source: www.patient.co.uk/doctor/hypercalcaemia.html

Treating Parathyroid Tumors

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 of the high likelihood that all glands will eventually be affected, such that future surgery in the same area will be prevented. Other surgeons believe that three-and-a-half glands should be removed, or that affected glands should be removed individually as needed, whenever a tumor arises (Subtotal Parathyroidectomy).

Many surgeons also advise a thymectomy (removal of the thymus gland in the upper chest) at the same time as a Subtotal or Total Parathyroidectomy, since extra parathyroid glands may be found in or around the thymus. Removal of the thymus may also reduce the risk of developing a thymic carcinoid (see Associated MEN1 Tumors).

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 tumor itself, it may be easier to remove. In the event of Total Parathyroidectomy, the patient will need lifelong calcium replacement medication with a form of Vitamin D (see below). Decisions regarding these issues will be discussed with you when you see your surgeon.

.

SURGERY

The surgeon makes a 2-5cm incision below the trachea (Adam's apple), in a prominent skin crease in the neck, through which the affected gland(s) are removed. It is possible for the patient to be up and about, eating and drinking the same or next day.

'Keyhole' (minimally invasive) surgery is not usually performed in diagnosed MEN1 patients since usually more than one gland will be affected and 'open' surgery provides a better view of all the glands

Hospital Stay

Usually a few days

Risks

Most common side effect of surgery is treatable episodes of low calcium (hypocalcemia), which causes tingling fingers, toes and lips and sometimes cramping, and requires immediate top off 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 mild hypocalcemia (2.00-2.12 mmol/L), whereas the symptoms listed above usually develop when levels are lower (<1.9 mmol/L). Some subtle signs that calcium levels may be slightly low include:

- Chvostek's sign - twitching of the face, mouth or nose when the facial nerves are tapped
- Trousseau's sign – spasm of the wrist and fingers when pressure is exerted on the upper arm (e.g. during blood pressure measurements)

MEDICATION

Vitamin D

(Cholecalciferol, Ergocalciferol, Calcitriol)

Vitamin D supplements in a capsule form, which aid absorption of calcium from the patient's diet. Taken once a day, this is often the only life-long medication required after total parathyroidectomy.

Calcium Carbonate

(Caltrate, Tums)

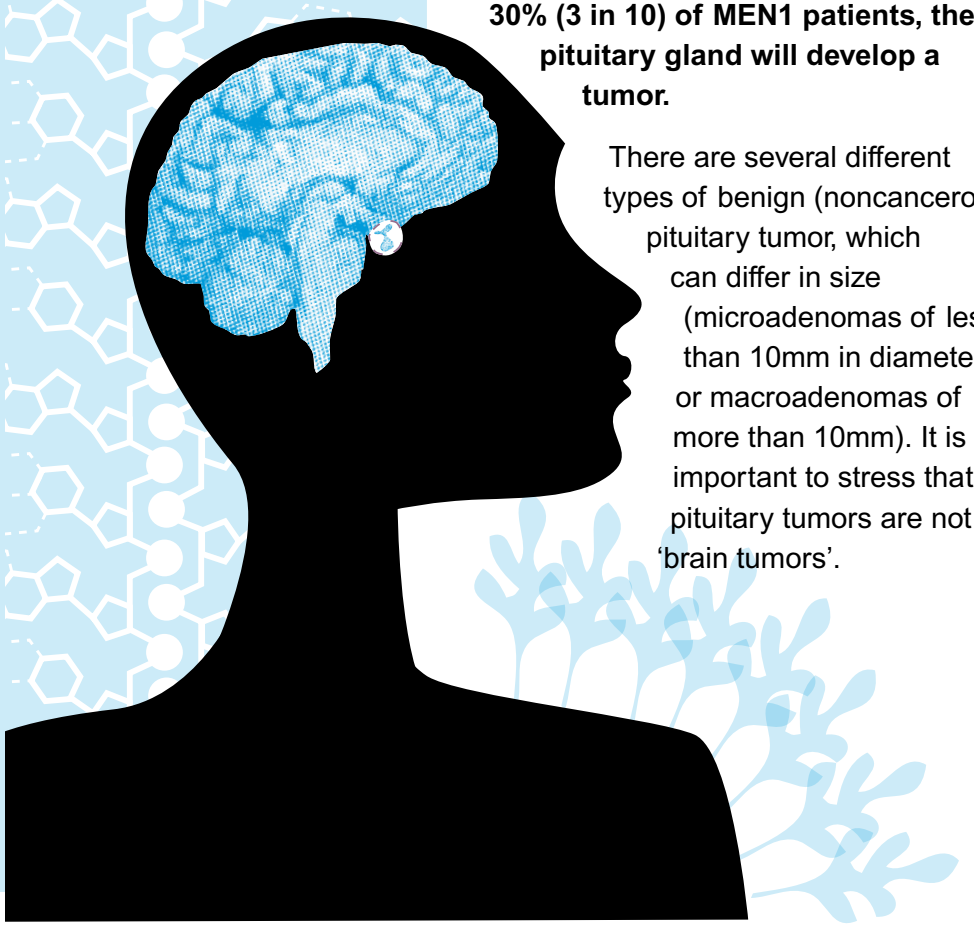
"top-off" after surgery, but is not necessarily required life-long. Too large a dose or an indication that this supplement is no longer needed may become apparent if the patient begins to suffer from headaches, nausea and vomiting.

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 Tumors

The pituitary gland sits near the base of the brain behind the nose, in a bony box called the sella turcica. It is very close to the optic nerves from the eyes and therefore, occasionally pituitary tumors can cause problems with vision. They may also cause headaches. Pituitary hormones are important for growth and development, metabolism (turning food into energy) and reproduction. **In around 30% (3 in 10) of MEN1 patients, the pituitary gland will develop a tumor.**



There are several different types of benign (noncancerous) pituitary tumor, which can differ in size (microadenomas of less than 10mm in diameter, or macroadenomas of more than 10mm). It is important to stress that pituitary tumors are not 'brain tumors'.

TYPE OF PITUITARY TUMOR	ACTION OF TUMOR	POSSIBLE SYMPTOMS	OTHER INFORMATION
Prolactinoma	Overproduces the hormone prolactin	Headaches, visual disturbances if tumor is large. Women: lactation (breast milk production) without pregnancy, lack of periods, may lead to infertility Men: erectile dysfunction and infertility	Most common pituitary tumor in MEN1
Somatotropinoma	Overproduces the growth hormone (GH) somatotropin	Causes a condition known as Acromegaly which is characterized by changes in appearance such as a large jaw and increasing size of hands and feet.	Somatotropin is the main hormone required for normal growth in childhood and adolescence
ACTH-producing	Overproduces the hormone Adrenocorticotropin (ACTH). ACTH controls the production and release of the adrenal gland hormone cortisol, which in turn helps maintain blood pressure, blood sugar levels, helps with recovery from injury and stress, and regulates the balance of mineral salts and the water content of the body	Causes a condition known as Cushing's Disease whose symptoms include weight gain, reddening of the face and neck, excess growth of body and facial hair, change of body shape and raised blood pressure.	These tumors may also push on the normal pituitary gland and stop it from working.
Non-functioning	Produce no obvious hormone	Headaches, visual disturbances due to local pressure	

Testing for Pituitary Tumors

All forms of pituitary tumor 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 follows)

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 Tumors

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 tumor and the amount of prolactin it produces. In some cases surgery (Transsphenoidal Resection), radiotherapy, or both may be needed.

SOMATOTROPINOMAS

Treatment will depend upon the size of the tumor and the age of the patient. Surgical removal (Transsphenoidal Resection) of the tumor 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 tumor from the pituitary gland, followed by radiotherapy if this is not completely successful. Rarely, removal of both adrenal glands may be required if Transsphenoidal Resection and radiotherapy are not successful.

SURGERY

Transsphenoidal Resection

This is the most common surgical method for removal of the pituitary gland and tumor. It is a relatively small operation carried out under general anesthetic. The surgeon makes a small cut in the front of the upper teeth behind the upper lip, or usually inside the nose. This way the surgeon can reach the pituitary gland without having to operate on the main part of your head. Patients can eat normally the following day.

Hospital Stay

Approximately 5 days

Recovery Time

Recovery time from surgery is approximately 1-2 weeks. Improvement of symptoms may take several weeks or months.

Risks

Diabetes insipidus

This occurs occasionally postoperatively. Symptoms include a great thirst and the need to pass urine more often than normal. If the condition becomes permanent, it can 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 tumor that cannot be treated with medicines or approached surgically. Alternatively, it may be used after surgery to decrease the chance of the tumor 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, making 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 Tumors

Tumors 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:

- insulin, which lowers blood sugar levels;
- glucagon, which raise 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 tumors are usually multifocal (occur in clusters of more than one) and up to half of them have the tendency to become malignant if left untreated.

The varied tumors occur in cells called Islets of Langerhans in the pancreas and the duodenum (the intestine next to the pancreas). About 10% (1 in 10) of MEN1 patients may experience more than one type of pancreatic tumor at some point. Most of these tumors will produce greater than normal amounts of hormones, but some may remain non-functioning.

TYPE OF TUMOR	ACTION OF TUMOR	POSSIBLE SYMPTOMS	OTHER INFORMATION
Gastrinomas	Overproduces the hormone gastrin	Stomach (peptic) ulcers and diarrhea, together sometimes referred to as Zollinger-Ellison syndrome (ZES)	Most common MEN1 Islet Cell tumor. Gastrinomas commonly occur in the forgut (duodenum) when associated with MEN1
Insulinomas	Overproduces the hormone insulin	Sweating and faintness due to low blood sugar levels (hypoglycemia)	May be located anywhere on the pancreas, although surgical removal is easier if on the tail (end) of the pancreas.
Glucogonomas	Overproduces the hormone glucagons	Skin rash and high blood sugar levels (hyperglycaemia)	
VIPomas	Overproduces the pancreatic protein, vasoactive intestinal peptide	Severe diarrhea	Very rare tumor whose effects are referred to as Verner-Morrison syndrome. Only reported in a few MEN1 patients
Somatostatinomas	Overproduces the hormone somatostatin which curbs the release and actions of many hormones	Severe diarrhea and formation of gallstones	
Non-Functioning	Do not appear to overproduce any hormones	None	

Testing for Pancreatic Tumors

Many pancreatic tumors, including non-functional tumors may be detected by a CT or MRI scan, although other types of imaging may be necessary if the tumors are very small or to confirm the tumor type. These include endoscopic ultrasound, where an ultrasound probe is passed down the throat to the gut (duodenum) on the end of a glass fiber 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:

GASTRINOMAS

Blood Tests

Serum gastrin A simple blood test after an overnight fast (annual from age 20 years).

Scans/Other

Basal acid output Rarely performed test where a tube is passed into the stomach (i.e. naso-gastric tube) to measure acid output.

Secretin-stimulated gastrin release An injection followed by the taking of blood samples to confirm the diagnosis of a gastrinoma.

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 TUMORS

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 tumor and its blood supply.

Treating Pancreatic Tumors

In the past, 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 tumors will depend upon their size and type as well as their specific locations.

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. Surgery is usually recommended only if the tumor is large or if it may have spread to other sites, thus suggesting that it may be cancerous.
Without surgery, the possible symptoms of ulcers and diarrhea 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 hypoglycemia due to insulinoma, but, very occasionally, the drug diazoxide can be used if the tumor is difficult to find.

OTHER (NON-FUNCTIONING) TUMORS

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

SURGERY AND MEDICATION

Pancreatic Enucleation

This involves the removal of only the tumor 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 week.

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 if necessary
Insulin injections to replace the insulin normally secreted by the pancreas if diabetes occurs.

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 hemorrhage requiring blood transfusion.

Medication

Pancreatic Enzymes taken with food to aid its digestion.

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

Other Associated MEN1 Tumors

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

CARCINOID TUMORS

Less than 5% (1 in 20) of MEN1 patients may experience a carcinoid tumor. These tumors overproduce the hormone serotonin, causing 'asthma', attacks of flushing and diarrhea (Carcinoid Syndrome). Carcinoid tumors are often found in the area of the lungs (upper chest and thymus), 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 Caring For Carcinoid Foundation in Other Useful Organizations). 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 embolization or radiofrequency ablation. Carcinoid tumors 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 mainly affect men and cause problems from local growth of the tumor rather than hormone production, and are best treated by surgical removal.

LIPOMAS

A common benign tumor of fat cells which are commonly found in up to 1 in 3 MEN1 patients. If they are a problem, they can usually be removed by a simple operation under general or local anaesthetic.

ADRENAL TUMORS

Benign tumors 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 tumors produce a condition called Cushing's syndrome, similar to that produced by ACTH-secreting tumors of the pituitary (see Pituitary Tumor – ACTH Tumor). 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 tumors may often be non-functional and usually do not need treatment.

ANGIOFIBROMAS

Small, benign, raised, red or flesh-colored spots on the face. May occur in greater than 60% (6 in 10) of MEN1 patients.

COLLAGENOMAS

Small, benign, white, raised spots that that may occur anywhere on the skin.

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 programs may be established from the outset, and conditions addressed and managed before serious symptoms develop. Prenatal testing is available. Would-be mothers can be referred to a genetics center 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 mutation. 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 counselor and/or endocrinologist.

Treatment and Testing Recommendations

Recommended testing program for children with MEN1

Blood Tests

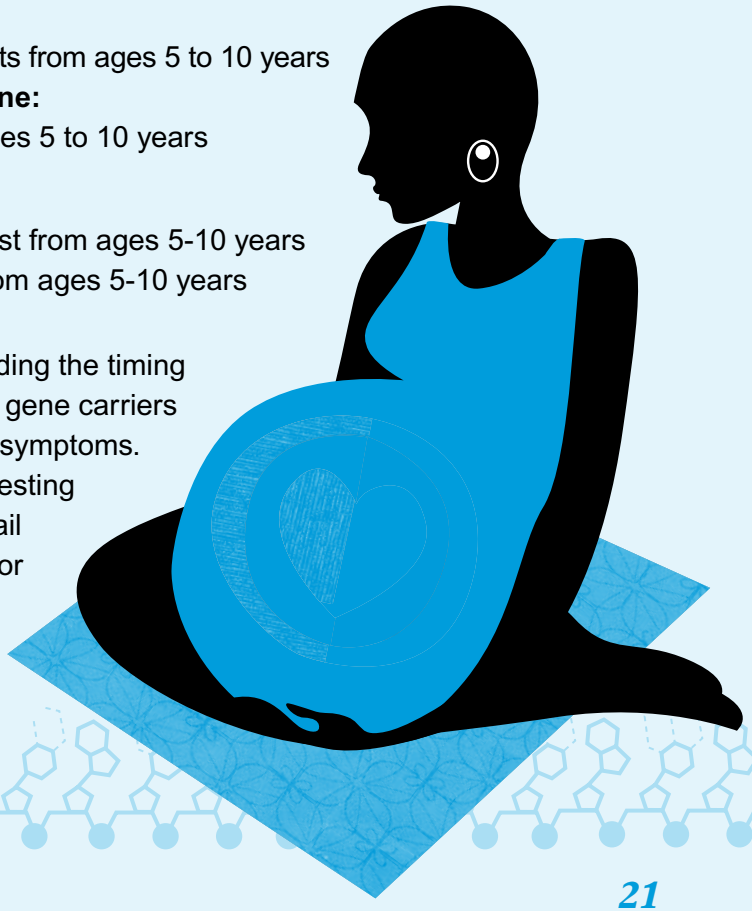
Parathyroids

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 endocrinologist or endocrine surgeon.



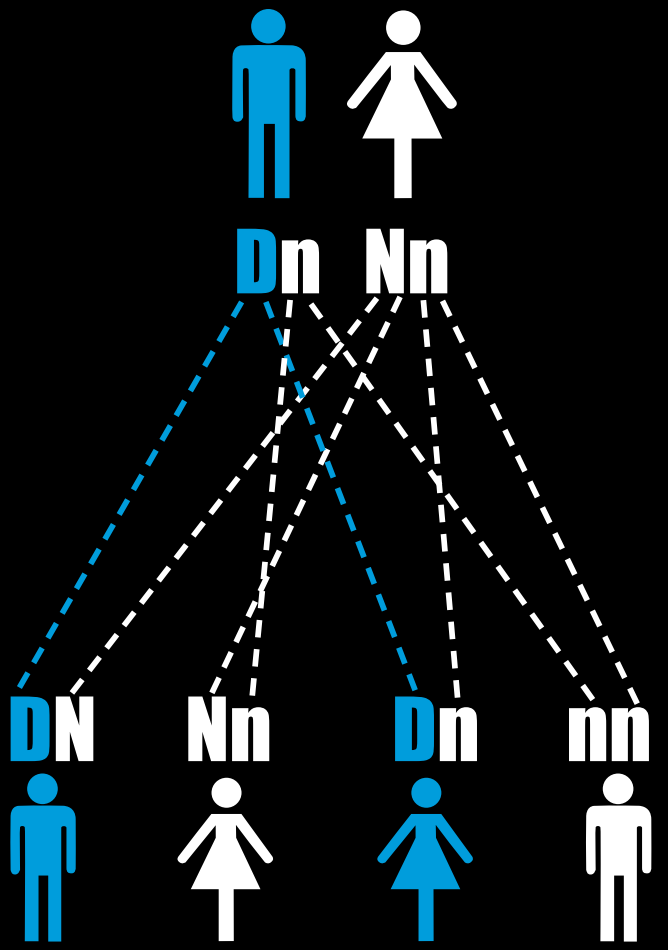
Blood Tests

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 anesthetic spray instead. A phlebotomist experienced in doing children’s blood tests is a must to ensure as few repeated pokes 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 de novo). 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 (colored blue, right), and is therefore predisposed to the tumors 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 counseled by a certified genetic counselor.

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 tests 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 testing, complications such as ulcers, kidney stones as a result of parathyroid tumors, and advanced pancreatic islet cell cancer may be drastically reduced.

Genetic testing and counseling is available and a referral to a genetic counselor is usually made through your primary physician or endocrinologist. Genetic counselors in your area may also be found through: www.nsgc.org, www.genetests.org.

Useful Information

MEDICALERT®: AMEND USA recommends that anyone taking lifelong medications obtain and wear a MedicAlert® identification emblem. The emblem contains summarized 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. Contact AMEND USA for an order form and brochure or join online at www.medicalert.org. Other medical identification products are available.

Useful Organizations

The Pituitary Society
Tel: 212-263-6772
www.pituitarysociety.org

American Diabetes Association
Tel: 1-800-342-2383
www.diabetes.org

Genetic Alliance
Tel: 1-202-966-5557
www.geneticalliance.org

Caring for Carcinoid Foundation (NET tumors)
Tel: 1-617-948-2514
www.caringforcarcinoid.org

AMEND USA Medical Advisory Team

- **Electron Kebebew** - National Cancer Institute, Endocrine Oncology Branch Chief
- **Constantine Stratakis -** Senior Investigator, National Institute of Child Health & Human Development
- **Thereasa Rich -** Certified Genetic Counselor, MD Anderson Cancer Center
- **Original author:** Mrs Jo Grey, AMEND CEO.
- **Original Medical Advisory Team: Professor Rajesh Thakker** (Oxford), **Dr Caroline Brain** (London), **Professor John Connell** (Dundee), **Professor Ashley Grossman** (Oxford)**, Mr Barney Harrison** (Sheffield), **Dr Fiona Lalloo** (Manchester), **Mr Tom Lennard** (Newcastle upon Tyne), **Mr David Scott-Coombes** (Cardiff)

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 doctor. Every care has been taken to ensure that the information contained in this book is accurate, nevertheless, AMEND USA cannot accept responsibility for any clinical decisions.

1st UK Edition May 2005; 2nd UK Edition February 2010, Review due 2015

notes