

NIH Clinical Center Patient Education Materials

Carney complex

Carney complex is a genetic disorder that affects many organs in the body. The disorder was named for Dr. J. Aiden Carney of the Mayo Clinic, who first described it in 1985. People with Carney complex often have skin pigments (similar to freckles), non-cancerous tumors (called myxomas), overactive endocrine glands, and other types of tumors.

This information covers many important issues for people with Carney Complex and their families:

Part 1: Symptoms

Part 2: Genes and Carney complex

Part 3: Screening

Part 4: Treatment

Part 5: Prenatal diagnosis and treatment

Part 6: Research

Part 7: Additional resources

Part 1: Symptoms

Lentiginos

Spotty skin pigments, called lentiginos (pronounced len-ti-ja-nee-z) occur in people with Carney complex. Lentiginos look like freckles, but, unlike freckles, lentiginos may appear at birth and do not always darken in the sun. Lentiginos usually appear on the lips, eyes, and mucous membranes. Lentiginos get darker during puberty but tend to fade after age 40. People with Carney complex can also have blue nevi (moles) and café-au-lait spots on the skin.



Figure 1: Lentiginos
[NICHD](#)

Myxomas

Myxomas (pronounced mix-oh-mas) are non-cancerous lesions that appear on the skin and in the heart and female breast tissue.

Skin (cutaneous) myxomas

Myxomas on the skin are small and colorless. They may appear in infancy and grow in areas such as the eyelid, ear canal, mouth, throat, nipple, and female genital area. People with Carney complex who have heart myxomas may also have skin myxomas.

Heart myxomas

People of all ages with Carney complex may have myxomas in the heart chambers. If myxomas get too large, surgery may be needed to prevent clots, uneven heart rhythm, or heart failure. Patients may also need surgery to prevent complications like clot formation, rhythm disturbances, heart failure, or strokes. Cardiac myxomas cause 25 percent of the deaths in patients with Carney complex.

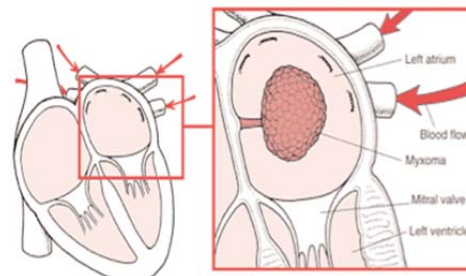


Figure 2: Myxomas in the heart
[Merck Manual: Myxoma](#)

Breast myxomas

Myxomas of the breast often affect both breasts, and they occur in more than 70 percent of women with Carney complex. A special type of MRI (magnetic resonance imaging) test is available that helps doctors tell the difference between myxomas and other breast lumps. This may help

prevent unneeded biopsies for women with this disorder.

Overactive endocrine glands

Carney complex can affect the body's endocrine glands or reproductive organs. Endocrine glands (adrenals, thyroid, and pituitary) make hormones that send chemical messages to other body organs.

Adrenal glands

Adrenal glands are a pair of walnut-sized organs above the kidneys. When the adrenal glands make too much of the hormone cortisol, Cushing's syndrome occurs. When Carney complex affects the adrenals, this is called Primary Pigmented Nodular Adrenocortical Disease (PPNAD). PPNAD causes Cushing's syndrome in patients with Carney complex. PPNAD causes Cushing's syndrome in patients with Carney complex. Symptoms of Cushing's syndrome are unexplained weight gain, abnormal fat distribution, excess hair growth, dark

pink/ purple stretch marks, fatigue, menstrual irregularity, and slow growth rate in children. If untreated, PPNAD can also cause hypertension, diabetes, and/or osteoporosis. When PPNAD causes Cushing's syndrome, the person may have no symptoms, or symptoms that come and go.

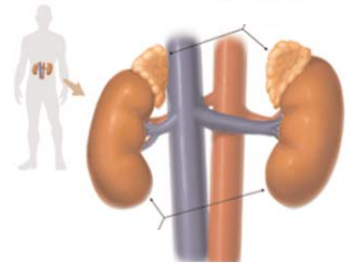
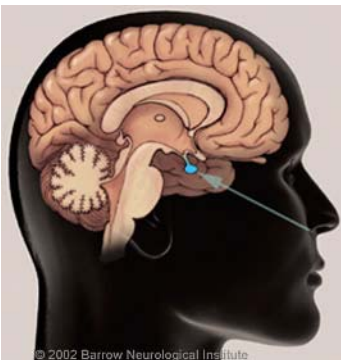


Figure 3:
Location of the adrenal glands
[NICHD](#)

Thyroid gland

Carney complex may cause thyroid nodules. On ultrasounds, these look like small cysts. In older patients, they grow into adenomas, so it is important to monitor them closely. Thyroid cancer may develop patients with Carney complex, but that is rare.



Pituitary gland

The pituitary gland is the master gland of the body. A tiny organ at the base of the brain, the pituitary controls many vital health functions. It makes hormones that signal other organs to make hormones that enable the body to work normally. Tumors on the pituitary (adenomas) occur in 10 to 15 percent of patients with Carney complex. These adenomas make the hormones named Growth Hormone (GH) and prolactin. When a person makes too much GH, levels of insulin and insulin growth factor (IGF-1) increase. Too much IGF-1 or GH causes gigantism (or excessive growth, acromegaly). In females, too much prolactin causes the

Figure 4: Location of the pituitary gland
[\(Barrow Neurologic Institute: Pituitary Center\)](#)

Reproductive organ tumors

Testicular tumors, called large-cell calcifying Sertoli cell tumors (LCCSCT), occur often in males with Carney complex. LCCSCTs look like small, calcified areas on an ultrasound of the testicles. Calcification is caused by a build-up of calcium salts in soft tissues. These areas become hard and calcified. LCCSCTs are usually benign and may occur with breast tissue enlargement (gynecomastia) in boys and men.

Women with Carney complex may have ovarian cysts or growths in the milk ducts of the breast (ductal adenomas). Usually, these are benign. Ovarian cancer may develop, but this is rare.

Tumors affecting nerves and bones

Nerve cells have "Schwann cells" around them for insulation. When Carney complex affects Schwann cells, growths that look like nerve bundles appear in scans. These growths are called psammomatous melanotic schwannomas (PMS). They are rare tumors affecting fewer than 10 percent of people with Carney complex. They occur at the ends of the outer parts of the nervous system and appear most often in the intestinal tract and

along the spinal nerves. An osteochondromyxoma (tumor of the bone) may also occur in patients with Carney complex. Both of these tumors are rare.

Part 2: Genes and Carney complex

An inherited disorder is one that can pass from parents to their children. Carney complex is an inherited disorder usually inherited through “autosomal dominant” transmission.

Autosomal dominance

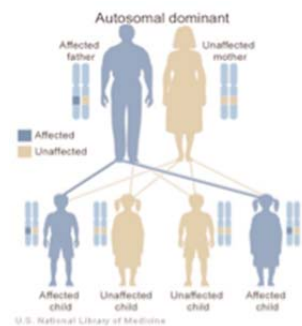


Figure 5: Autosomal dominant inheritance [National Library of Medicine: Genetics Home](#)

Inheriting a disease, condition, or trait depends on the type of chromosome affected (autosomal or sex chromosome). It also depends on whether the trait is dominant or recessive. Dominant inheritance means that an abnormal gene from one parent can cause disease, even though the matching gene from the other parent is normal. The abnormal gene "dominates" the pair of genes. When a disease is autosomal dominant, someone needs to only get the abnormal gene from one parent to inherit the disease. One parent may often have the disease. When one parent has Carney complex and the autosomal dominant mutated gene, there is a 50 percent chance that each child born will have the same faulty gene. Genetic counseling is important for people with

Carney complex who plan to have a family.

Gene causing Carney complex A faulty gene called PRKAR1A most often causes Carney complex. This gene is located on chromosome 17. Researchers think that this gene suppresses tumor growth. When the gene is faulty, tumors occur when they would not in someone with a normal PRKAR1A gene. In some cases, defects in genes on chromosome 2 or PRKACA, PRKCAB, PDE11A, or PDE8B cause Carney complex.

Carney complex may also occur without any other family members having the faulty gene. Doctors call these sporadic or de novo mutations.

Gender differences

Carney complex can affect males and females equally. But, some conditions, like Cushing’s syndrome, occur more often in women and young girls.

Part 3: Screening

Initial Work-Up

Screening for Carney complex must be thorough to cover all organs the disorder could affect. These screening tests include:

- Heart tests (for myxomas)
- Echocardiogram
- Ultrasounds
- MRI for older patients

Adrenal glands

- Blood tests for cortisol and ACTH
- 24-hour urine test for cortisol, creatinine, and 17-hydroxysteroids, dexamethasone suppression test (Liddle’s)
- CT scan to check for enlargement

Pituitary glands

- Blood drawings to check hormone levels of cortisol, GH, prolactin, and IGF-1
- MRI scans
- Specialized hormone tests to check cortisol and ACTH

Thyroid glands

- Blood test for thyroid hormone levels (TSH and Free T4)
- Ultrasound

Reproductive organ system

- Blood drawings to check gonadotropin levels
- Testicle ultrasound
- Ovary ultrasound

Nerve cells

- MRI of the chest abdomen, pelvis, and spine to check for schwannomas

Genetic testing

Screening tests for Carney complex often depend on the person's age and whether doctors find tumors or abnormal organ function.

Before puberty

- Boys and girls who have not reached puberty need to be checked for normal growth rate as well as for levels of cortisol, growth hormone, or estrogen/testosterone.
- To check for heart myxomas, children should get an echocardiogram every year. If the child has already had heart myxomas removed by surgery, he or she should have an echocardiogram every 6 months.
- Boys should get testicle ultrasounds every year to check for large-cell calcifying Sertoli cell tumors (LCCSCTs).
- Girls and women should have yearly ultrasounds of the ovaries to check for cysts or adenomas.

After puberty

The same screening tests done before puberty are needed after puberty:

- Thyroid ultrasounds yearly to check for nodules or adenomas
- 24-hour urine samples to test for free cortisol levels
- Blood tests to check for IGF-1

If organ enlargement or tumors are found at diagnosis, more tests are needed.

Adrenal enlargement (hyperplasia):

- Blood tests to check cortisol and dexamethasone
- Scans to check size of adrenal glands

Pituitary tumors:

- Oral glucose tolerance test to check GH
- MRI to check size and function

Schwannomas

- MRI yearly to check the brain, spine, chest, abdomen, and pelvis

Screening Test Tool

Age/Diagnosis	Screening test	How often
Before puberty	Echocardiogram	Annually Bi-annually with a history of excised myxomas
	Testicular ultrasound	Annually
	Growth rate monitoring and pubertal staging	Annually
After puberty	Echocardiogram	Annually Bi-annually with a history of excised myxomas
	Testicular ultrasound	Annually
	Urinary free cortisol levels	Annually
	Serum IGF-1 levels	Annually
	Thyroid ultrasound	Baseline (repeat as needed)
	Ovarian ultrasound	Baseline (repeat as needed)
PPNAD	Urinary free cortisol levels	Annually
	Diurnal cortisol levels	Baseline (repeat as needed)
	Dexamethasone-stimulation test	Baseline (repeat as needed)
	Adrenal CT	Baseline (repeat as needed)
Gigantism/acromegaly	Serum IGF-1 levels	Annually
	Pituitary MRI	As needed
	3-hr oral glucose tolerance test	As needed
	Serum GH, PRL levels	Baseline (repeat as needed)
PMS	MRI of brain, spine, chest abdomen, retroperitoneum, and pelvis	Annually

Part 4: Treatment

Unfortunately, there is no cure for Carney complex. But, regular screening can help find problems early so that treatment can begin.

Symptom	Treatment
Thyroid adenomas	Usually none
Thyroid cancer	Surgery
Pituitary tumors	Medication for excess GH, radiation
Heart myxomas	Surgery
Skin myxomas	Surgery
High levels of cortisol from adrenal glands	Surgery and medication
LCCSCT	Medication, rare surgery

Part 5: Prenatal diagnosis and fertility

Can Carney complex be diagnosed before birth?

Individuals with Carney complex who test positive for the gene mutation can get prenatal testing. Talking with a genetic counselor is important for people with Carney complex who want to have families.

Do women or men with Carney complex have fertility problems?

Women with Carney complex may have abnormal menstrual cycles caused by abnormal cortisol production or cysts of the ovaries. (These conditions affect normal ovulation.) Men with Carney complex may have fertility problems caused by calcification in the testes due to LCCSCT. Infertility may result from blockages in the sperm tubules or by abnormal hormone levels.

Part 6: Research

NIH scientists are studying the genetic changes that occur in people with Carney complex. They are also working with scientists in other research centers to learn how these gene changes cause the physical problems seen in people with Carney complex.

By understanding what causes the disorder and how it affects the people who develop it, scientists can find ways to better diagnose and treat Carney complex.

Part 7: Additional resources

Internet resources

[NIH Clinical Trials](#)

[National Library of Medicine: Carney Complex](#)

For more information

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