



Cancer Predisposition Clinic

Familial Adenomatous Polyposis

Also called: FAP, Attenuated Familial Adenomatous Polyposis, Gardner syndrome, Turcot syndrome

What is familial adenomatous polyposis?

Familial adenomatous polyposis is a condition that mostly affects the digestive system. People with familial adenomatous polyposis typically develop abnormal tissue growths in the large and small intestines. These growths are called polyps. If not removed, some of these polyps can become cancerous over time. For this reason, people with familial adenomatous polyposis are at high risk to develop colon cancer and other digestive system cancers at a young age.

Besides polyps, people with familial adenomatous polyposis are at increased risk to develop other tumors or cancers, and they may have other physical findings.

Familial adenomatous polyposis is hereditary, which means it can be passed from parents to their children.

There are four subtypes of familial adenomatous polyposis.

- **Classic familial adenomatous polyposis:** People with this subtype usually develop at least 100 polyps, but usually many more, in the large and small intestines by the time they are adults.
- **Attenuated familial adenomatous polyposis (AFAP):** People with this subtype have fewer polyps in the large and small intestines, usually no more than 30 by the time they are adults.
- **Gardner syndrome:** People with this subtype have the polyps seen in classic familial adenomatous polyposis plus osteomas, epidermal cysts, fibromas and desmoid tumors.
- **Turcot syndrome:** People with this subtype have the polyps seen in classic familial adenomatous polyposis plus a type of brain tumor known as medulloblastoma.

What is the cancer risk for people with familial adenomatous polyposis?

Cancer type	Lifetime Chance
Colon cancer (if colon is not removed)	70%–100%
Small intestines	4%–12%
Thyroid cancer	1%–12%
Hepatoblastoma (childhood liver cancer)	Less than 2%
Medulloblastoma (childhood brain cancer)	Less than 1%
Pancreatic cancer	Less than 1%
Stomach cancer	Less than 1%
Bile duct cancer (cancer of the tubes that drain bile from the liver into the gallbladder)	Less than 1%

Cancers in the large and small intestines

The major cancer risk in familial adenomatous polyposis is cancer in the large and small intestines. For people with classic familial adenomatous polyposis, Gardner syndrome and Turcot syndrome, polyps in the colon often start appearing around age 16. They can appear as early as 7 years of age or as late as 35.

By age 35, about 95% of people with these conditions have developed polyps in the colon. Without surgery to remove the colon, people with these types of familial adenomatous polyposis will all

eventually develop colon cancer. The average age of colon cancer in people with familial adenomatous polyposis who have not had their colon removed is around 39 years of age.

People with classic familial adenomatous polyposis, Gardner syndrome, and Turcot syndrome are also at risk for small intestine cancer. The lifetime risk of small intestine cancer is 4% to 12%. Small intestine cancer usually occurs after the age of 17 years. The average age of diagnosis is between 45 and 52 years.

For people with attenuated familial adenomatous polyposis, the lifetime risk of colon cancer is about 70%. For those with this subtype who have not had their colon removed, the average age of colon cancer diagnosis is 50 to 55 years.

Cancers that can occur in children with familial adenomatous polyposis

Hepatoblastoma is a liver cancer most often seen in children under the age of four years.

Medulloblastoma is a brain cancer that also typically occurs during childhood.

What are other physical findings seen in people with familial adenomatous polyposis?

Other findings	Lifetime Chance
Epidermoid cysts and fibromas (non-cancerous growths under the skin)	50%
CHRPE (congenital hypertrophy of the retinal pigment epithelium)*	Up to 56%
Desmoid tumors (non-cancerous tumors in the soft tissues, usually in the abdomen)	20%–30%
Osteomas (non-cancerous growths of the bones)	20%
Dental problems [§]	17%
Adrenal tumors (non-cancerous tumors in the small organ located on top of each kidney)	7%–13%

* CHRPE: pigmented areas on the tissue in the back of the eye; CHRPE does not cause vision problems and does not need treatment

[§] Dental: teeth that do not erupt through the gums, extra teeth or missing teeth, cysts

What causes familial adenomatous polyposis?

Familial adenomatous polyposis is caused by changes in a gene known as *APC*. Genes carry information telling cells within the body how to function. The *APC* gene helps to control how and when cells grow, divide and die.

Most people without familial adenomatous polyposis carry two working copies of the *APC* gene in their cells. One copy is inherited from the mother and one from the father. Cells from people with familial adenomatous polyposis carry one working copy of *APC* and one copy that is changed. This change causes the gene to not work properly. It is called an *APC* mutation.

Most children with familial adenomatous polyposis inherit the *APC* gene mutation from a parent who also has the syndrome. About 20% to 25% of people with familial adenomatous polyposis have a new *APC* mutation that did not come from a parent. These children have no history of the syndrome in their family. In these cases, the change either happened in an egg or sperm cell when the child was formed or in one of the child's cells during pregnancy. These children are the first in their families to have familial adenomatous polyposis. No matter how they acquired the *APC* mutation, people with familial adenomatous polyposis have a 50% or 1 in 2 chance of passing it on to their children.



As people with familial adenomatous polyposis get older, the remaining working copy of *APC* often becomes changed within some of their cells. When both copies of the gene are changed, cancer can develop. That is why people with familial adenomatous polyposis have a higher risk of developing cancer than people who do not have this condition.

How are people with familial adenomatous polyposis screened for tumors?

Familial adenomatous polyposis is one of the only cancer predisposition syndromes for which a treatment is available to prevent cancer. The treatment involves removing polyps and, eventually, the colon. This treatment can greatly reduce or even end the risk of developing colon cancer.

People with familial adenomatous polyposis should be managed by a health care provider who knows this condition well.

Screening is recommended for all people with this condition. The goal of screening is finding and treating tumors early to allow the best outcome for patients.

Recommended screenings for children with familial adenomatous polyposis include the following:

- **Yearly physical exams** by a health care provider who knows this condition well. The health care provider should pay special attention to symptoms in the abdomen or nervous system, and whether the thyroid is enlarged or has nodules.
- **Ultrasound exams** to screen for liver cancer. These should be started in infancy and repeated every three months until age 4 years.
- **A blood test to check the levels of alpha-fetoprotein (AFP)**. AFP is a protein that is often released by liver cancer cells. Checking a child's levels of AFP in the blood can help screen for liver cancer. Levels should be checked beginning in infancy and repeated every three months until age 4 years.
- **Sigmoidoscopy or colonoscopy** to look for polyps and cancer in the large intestine. In both procedures, a small camera allows a health care provider to look inside the intestine. A colonoscopy looks at the entire large intestine. A sigmoidoscopy looks at a shorter portion of the large intestine. These procedures should be done starting at age 10 to 12 years or 5–10 years before the earliest intestinal cancer diagnosis in the family. They should be repeated every 1 to 2 years.
- **Esophagogastroduodenoscopy (EGD)** uses a small camera to look for polyps and cancer in the upper part of the digestive system. EGD should be done before colon is removed, beginning by age 20- 25, or starting at 5–10 years before the earliest age of small bowel cancer in the family. If patient is having colectomy, baseline EGD prior to colectomy.
- **Thyroid exam** starting in the late teens and repeated every year. Some health care providers may recommend an ultrasound exam of the thyroid every year.
- **Baseline brain MRI** could be considered for families with a history of medulloblastoma or other brain tumors.

Recommended screenings for adults with familial adenomatous polyposis include the following:

- **Yearly physical exams** by a health care provider who knows this condition well. The health care provider should pay special attention to sign and symptoms in the abdomen, nervous system and thyroid.
- **Thyroid exam** every year. Some health care providers may recommend an ultrasound exam of the thyroid every year.
- **Continue sigmoidoscopy or colonoscopy** as recommended by gastroenterologist (GI health care provider).



- **EGD** (described above) should be done before the colon is removed or beginning by age 20-25 or starting at 5 – 10 years before the earliest age of small bowel cancer in the family. How often EGD is repeated depends on the findings of the first exam.
- **Baseline brain MRI** could be considered for families with a history of brain tumors.

Recommended screenings for attenuated familial adenomatous polyposis:

Screenings for attenuated familial adenomatous polyposis are different than other forms of familial adenomatous polyposis and should be discussed with a health care provider who knows this condition well.

It is possible that recommended screenings may change over time as health care providers learn more about familial adenomatous polyposis and all of the subtypes. Parents should discuss all screening options for their child with a health care provider who knows this condition well. Because familial adenomatous polyposis is a complex condition, it is important that parents seek out an experienced health care provider for their child.

How is genetic testing for familial adenomatous polyposis done?

The health care provider may suspect familial adenomatous polyposis after looking at a person's medical or family history. In most cases, a health care provider or genetic counselor will ask questions about a person's health and the health of other family members.

The genetic counselor or health care provider will record which family members have developed tumors, what types of tumors and at what ages tumors occurred. From this information they will create a family tree. Health care providers and genetic counselors will look at the family tree to find out:

- If there are more cancers than normal.
- If cancers occurred at younger-than-expected ages and
- If the types of tumors match up with what might be seen in those with familial adenomatous polyposis.

If familial adenomatous polyposis is suspected in a child or other family members, the health care provider or genetic counselor will likely recommend genetic testing of the *APC* gene.

Diagnostic genetic testing

If the health care provider or genetic counselor suspects that a person has familial adenomatous polyposis, diagnostic testing may take place as follows:

- A blood sample is collected.
- DNA is isolated from the cells in the sample. A person's genes are made of DNA.
- Both copies of the person's *APC* gene are checked for possible changes. A genetic specialist compares the two copies of the patient's gene to a normal *APC* gene. If there are differences, the specialist decides if they might cause a certain condition such as familial adenomatous polyposis.
- If a *APC* mutation is found, the genetic counselor will work with the family in the following ways:
 - To help the family understand the cancer risks of familial adenomatous polyposis
 - To find out if other family members should consider testing
 - To help with decisions about prenatal genetic testing

It is important to remember that genetic testing does not always find a mutation in the *APC* gene for all people with familial adenomatous polyposis. A person can still have familial adenomatous polyposis even if no *APC* mutation is found.

Prenatal genetic testing

Parents may undergo prenatal testing to find out if the pregnancy is affected with a known *APC* mutation in the family. Testing may take place either before pregnancy occurs or during pregnancy.

People considering prenatal testing should work with a genetic counselor to review the pros and cons of the testing. The genetic counselor can also help parents consider how they wish to handle the results of the testing.

Testing that occurs before pregnancy—Testing that happens before pregnancy is called preimplantation genetic testing (PGT). This special type of genetic testing is done along with in vitro fertilization (IVF). PGT offers a way to test embryos for a known *APC* mutation before placing them into the uterus.

Testing that occurs during pregnancy—Testing can be used to see if a pregnancy is affected with a known *APC* mutation. A doctor gathers cells from the pregnancy in one of two ways:

- **Chorionic villus sampling (CVS)**—during the first trimester (first three months)
- **Amniocentesis**—during the second trimester or later (last six months)

Collected tissue can be checked for the presence of the *APC* mutation identified in the family.

Both of these tests carry minor risks and should be discussed with an experienced health care provider or genetic counselor.

Special concerns

Genetic testing for familial adenomatous polyposis is a complex process. Those thinking about testing should take time to consider the benefits and risks. They should discuss the process with a genetic counselor before testing is done. If they choose testing, they should review the test results with the health care provider or genetic counselor to be sure they understand the meaning of the results.

Sometimes children or adults with familial adenomatous polyposis can feel sad, anxious or angry. Parents who pass on an *APC* mutation to one or more of their children can feel guilty. Some people with an *APC* mutation could have trouble getting disability coverage, life insurance, or long-term care insurance in some states. More information about genetic discrimination can be found at www.ginahelp.org.

Are there other special health care needs for children with familial adenomatous polyposis?

People of any age with familial adenomatous polyposis have a higher risk of cancer. They should monitor their health and adopt healthy habits throughout life. It is important to continue to have regular physical checkups and screenings. That way, any cancer can be found early at the most treatable stage.

Other ideas to reduce the risk of cancer include the following:

- Eat a healthy diet with lots of fruits and vegetables
- Get regular exercise



- Avoid smoking or using tobacco products
- Avoid secondhand smoke
- Avoid excess sun exposure and always wear sunscreen, hat and protective clothing when out in the sun

People with familial adenomatous polyposis should watch closely for general signs or symptoms that could signal cancer:

- Unexplained weight loss
- Loss of appetite
- Pain in abdomen
- Blood in the stool or changes in bowel habits
- Aches, pains, lumps or swelling that cannot be explained
- Headaches or changes in vision or nerve function that do not go away

It is important to seek medical help if anything unusual appears.

What other information and resources are there for children with familial adenomatous polyposis and their families?

Resources about familial adenomatous polyposis:

- Genetics Home Reference (ghr.nlm.nih.gov/condition/familial-adenomatous-polyposis)
- Cancer.net familial adenomatous polyposis (www.cancer.net/cancer-types/familial-adenomatous-polyposis)
- Familial Adenomatous Polyposis Gene Support Group (www.fapgene.com)
- PolyPeople (www.polypeople.online)
- Hereditary Colon Cancer Takes Guts (www.hcctakesguts.org)
- Colon Cancer Alliance (www.ccalliance.org)

Other resources:

- Making Sense of Your Genes: A Guide to Genetic Counseling (www.ncbi.nlm.nih.gov/books/NBK115508/)
- Young People with Cancer: A Parent's Guide (www.cancer.gov/publications/patient-education/young-people)

Sources:

1. Genetics Home Reference - Familial adenomatous polyposis ghr.nlm.nih.gov/condition/familial-adenomatous-polyposis
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