Treating Pancreatic Neuroendocrine Tumors

If you've been diagnosed with a pancreatic neuroendocrine tumor (NET), your cancer care team will discuss your treatment options with you. It's important to weigh the benefits of each treatment option against the possible risks and side effects.

How are pancreatic neuroendocrine tumors treated?

Depending on the type and stage of the cancer and other factors, treatment options for people with pancreatic neuroendocrine tumor (NET) can include:

- Surgery for Pancreatic Neuroendocrine Tumor
- Ablation or Embolization Treatments for Pancreatic Neuroendocrine Tumor
- Radiation Therapy for Pancreatic Neuroendocrine Tumor
- Chemotherapy for Pancreatic Neuroendocrine Tumor
- Targeted Therapy for Pancreatic Neuroendocrine Tumor
- Other Drugs for Pancreatic Neuroendocrine Tumors

Common treatment approaches

For pancreatic neuroendocrine tumors (NETs), treatment options might include surgery, ablation or embolization treatments, radiation therapy, or different types of medicines.

- Treating Pancreatic Neuroendocrine Tumor, Based on Extent of the Tumor

Who treats pancreatic neuroendocrine tumors?

Depending on the resources available in your community, you can have different types

of doctors on your treatment team. The doctors on your cancer treatment team might include:

- A **surgeon:** a doctor who uses surgery to treat cancers or other problems
- An **endocrinologist:** a doctor who specializes in the diagnosis and treatment of diseases involving hormones
- A **radiation oncologist:** a doctor who specializes in treating cancer with radiation
- A **medical oncologist:** a doctor who specializes in treating cancer with chemotherapy, immunotherapy, targeted therapy and other medicines
- A **gastroenterologist**: a doctor who specializes in diagnosing and treating diseases of the digestive system.

Many other specialists may be involved in your care as well, including nurse practitioners, nurses, psychologists, social workers, rehabilitation specialists, and other health professionals.

- Health Professionals Associated With Cancer Care[1]

Making treatment decisions

It's important to discuss all of your treatment options, including their goals and possible side effects, with your doctors to help make the decision that best fits your needs. Some important things to consider include:

- Your age and expected life span
- Any other serious health conditions you have
- The stage (extent) of your cancer
- Whether or not surgery can remove (resect) the cancer
- The likelihood that treatment will cure the cancer (or help in some other way)
- Your feelings about the possible side effects from treatment

You may feel that you must make a decision quickly, but it's important to give yourself time to absorb the information you have just learned. Ask questions if there is anything you're not sure about.

If time permits, it is often a good idea to seek a second opinion. A second opinion can give you more information and help you feel more confident about the treatment plan you choose.

- Questions to Ask About Pancreatic Neuroendocrine Tumor[2]
- Seeking a Second Opinion[3]

Thinking about taking part in a clinical trial

Clinical trials are carefully controlled research studies that are done to get a closer look at promising new treatments or procedures. Clinical trials are one way to get state-of-the art cancer treatment. In some cases they may be the only way to get access to newer treatments. They are also the best way for doctors to learn better methods to treat cancer. Still, they're not right for everyone.

If you would like to learn more about clinical trials that might be right for you, start by asking your doctor if your clinic or hospital conducts clinical trials.

- Clinical Trials[4]

Considering complementary and alternative methods

You may hear about alternative or complementary methods that your doctor hasn't mentioned to treat your cancer or relieve symptoms. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

Complementary methods refer to treatments that are used along with your regular medical care. Alternative treatments are used instead of a doctor's medical treatment. Although some of these methods might be helpful in relieving symptoms or helping you feel better, many have not been proven to work. Some might even be harmful.

Be sure to talk to your cancer care team about any method you are thinking about using. They can help you learn what is known (or not known) about the method, which can help you make an informed decision.

- Complementary and Alternative Medicine[5]

Help getting through cancer treatment

People with cancer need support and information, no matter what stage of illness they may be in. Knowing all of your options and finding the resources you need will help you make informed decisions about your care.

Whether you are thinking about treatment, getting treatment, or not being treated at all, you can still get supportive care to help with pain or other symptoms. Communicating with your cancer care team is important so you understand your diagnosis, what treatment is recommended, and ways to maintain or improve your quality of life.

Different types of programs and support services may be helpful, and can be an important part of your care. These might include nursing or social work services, financial aid, nutritional advice, rehab, or spiritual help.

The American Cancer Society also has programs and services – including rides to treatment, lodging, and more – to help you get through treatment. Call our National Cancer Information Center at 1-800-227-2345 and speak with one of our trained specialists.

- Palliative Care[6]
- Find Support Programs and Services in Your Area[7]

Choosing to stop treatment or choosing no treatment at all

For some people, when treatments have been tried and are no longer controlling the cancer, it could be time to weigh the benefits and risks of continuing to try new treatments. Whether or not you continue treatment, there are still things you can do to help maintain or improve your quality of life.

Some people, especially if the cancer is advanced, might not want to be treated at all. There are many reasons you might decide not to get cancer treatment, but it's important to talk to your doctors and you make that decision. Remember that even if you choose not to treat the cancer, you can still get supportive care to help with pain or other symptoms.

- If Cancer Treatments Stop Working[8]

The treatment information given here is not official policy of the American Cancer Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor. Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

Surgery for Pancreatic Neuroendocrine Tumor

Two general types of surgery can be used for pancreatic neuroendocrine tumors (NETs):

- **Potentially curative surgery** is used when the results of exams and tests suggest that it's possible to remove (resect) all the cancer.
- **Palliative surgery** may be done if imaging tests show that the cancer is too widespread to be removed completely. This surgery is done to reduce tumor size to relieve symptoms from excess hormone production or to prevent certain complications like a blocked bile duct or intestine. The goal is not to try to cure the cancer.

Before any surgery is done, it is important to treat and control any symptoms caused by too much hormone production. This may be done by starting somatostatin analog drugs or other medicines.

Laparoscopy to stage the cancer

To determine which type of surgery might be best, it's important to know the stage[1] (extent) of the cancer. Sometimes it can be hard to stage pancreatic NETs accurately just using imaging tests[2]. Exploratory laparoscopy may be done first to help determine the extent of the cancer and if it can be resected.

For this procedure, the surgeon makes a few small incisions (cuts) in the abdomen (belly) and inserts long, thin instruments. One of these has a small video camera on the end so the surgeon can see inside the abdomen. The surgeon can look at the pancreas and other organs for tumors and take biopsy[3] samples of abnormal areas to learn how far the cancer has spread.

Potentially curative surgery

Pancreatic NETs that have not spread outside the pancreas should be completely removed, if possible, because these tumors are more likely to be cured with surgery. Sometimes, however, after the surgeon starts the operation it becomes clear that the cancer has grown too far to be completely taken out. If this happens, the operation may

be stopped, or the surgeon might continue with a smaller operation to help prevent or relieve symptoms. (See “Palliative surgery” below.) This is because the planned operation would be very unlikely to cure the cancer and could still lead to major side effects. It would also make the recovery time longer, which could delay other treatments.

Many of these types of surgery are complex and can be very hard for patients. They can cause complications and can take weeks or months to make a full recovery. If you're thinking about having this type of surgery, it’s important to weigh the potential benefits and risks carefully.

Types of potentially curative surgery include enucleation (removing only the tumor), central pancreatectomy, distal pancreatectomy, the Whipple procedure (pancreaticoduodenectomy), and total pancreatectomy. The type of surgery needed depends on several factors, including the location, size, and specific kind of pancreatic NET (functioning or nonfunctioning).

Enucleation (removing just the tumor)

Sometimes if a pancreatic NET is small, just the tumor itself is removed. This is called *enucleation*. This operation may be done using a laparoscope, so that only a few small cuts on the belly are needed.

This operation may be all that is needed to treat an insulinoma. Small gastrinomas and some other pancreatic NETs may also be treated with enucleation, but sometimes the duodenum (the first part of the small intestine) is removed as well.

The lymph nodes[4] around the pancreas might also be removed so that they can be checked for cancer cells.

Central pancreatectomy

A central pancreatectomy is used to treat small, low grade tumors. For this operation, the surgeon removes only the neck and part of the body of the pancreas keeping the head and tail intact. This helps maintain most of the function of the pancreas.

Distal pancreatectomy

A distal pancreatectomy is used to treat pancreatic NETs found in the tail and body of the pancreas. In this operation, the surgeon removes only the tail of the pancreas or the tail and a portion of the body of the pancreas. The spleen is usually removed as well.

The spleen helps the body fight infections, so if it's removed you'll be at increased risk of infection with certain bacteria. To help with this, doctors recommend that patients get certain vaccines before this surgery.

Whipple procedure (pancreaticoduodenectomy)

A Whipple procedure is used to treat pancreatic NETs found in the head of the pancreas. During this operation, the surgeon removes the head of the pancreas and sometimes the body of the pancreas as well. Nearby structures such as part of the small intestine, part of the bile duct, the gallbladder, lymph nodes near the pancreas, and sometimes part of the stomach are also removed. The remaining bile duct and pancreas are then attached to the small intestine so that bile and digestive enzymes can still go into the small intestine. The pieces of the small intestine (or the stomach and small intestine) are then reattached so that food can pass through the digestive tract.

Most often, this operation is done through a large incision (cut) down the middle of the belly. Some doctors at major cancer centers also do the operation laparoscopically, which is sometimes known as *keyhole surgery* (see What's New in Pancreatic Neuroendocrine Tumor Research?[5]).

This is a very complex operation that requires a surgeon with a lot of skill and experience. It carries a relatively high risk of complications that can be life threatening. When the operation is done in small hospitals or by doctors with less experience, as many as 15% of patients may die as a result of surgical complications. In contrast, when the operation is done in cancer centers by surgeons experienced in the procedure, less than 5% of patients die as a direct result of surgery.

To have the best outcome, it's important to be treated by a surgeon who does many of these operations and to have the surgery at a hospital where many of them are done. In general, people having this type of surgery do better when it's done at a hospital where at least 15 to 20 Whipple procedures are done per year.

Still, even under the best circumstances, many patients have complications from the surgery. These can include:

- Leaking from the various connections between organs that the surgeon has joined
- Infections
- Bleeding
- Trouble with the stomach emptying after eating
- Trouble digesting some foods (which might require taking pancreatic enzymes in pill form to help with digestion)

- Weight loss
- Changes in bowel habits
- Diabetes

Total pancreatectomy

Total pancreatectomy might be an option if the cancer has spread throughout the pancreas but can still be removed. This operation removes the entire pancreas, as well as the gallbladder, part of the stomach and small intestine, and the spleen. But this type of surgery is used less often than the other operations because there doesn't seem to be a major advantage in removing the whole pancreas, and it can have major side effects.

It's possible to live without a pancreas. But when the entire pancreas is removed, people are left without the cells that make insulin and other hormones that help maintain safe blood sugar levels. These people develop diabetes, which can be hard to manage because they are totally dependent on insulin shots. People who have had this surgery also need to take pancreatic enzyme pills to help them digest certain foods.

Before you have this operation, your doctor will recommend that you get certain vaccines because the spleen will be removed.

Palliative surgery

If the cancer has spread too far to be removed completely, any surgery being considered would be palliative (intended to relieve symptoms). This type of surgery may be considered in some people with pancreatic NETs whose tumor has recurred and is causing local problems or is making too many hormones that are causing symptoms.

Sometimes surgery might be started with the hope it will cure the patient, but once it begins the surgeon discovers this is not possible. In this case, the surgeon might do a less extensive, palliative operation known as *bypass surgery* instead to help prevent or relieve symptoms.

Cancers growing in the head of the pancreas can block the common bile duct as it passes through this part of the pancreas. This can cause pain and digestive problems because bile can't get into the intestine. The bile chemicals will also build up in the body, which can cause jaundice, nausea, vomiting, and other problems.

There are 2 main options for relieving bile duct blockage: stent placement, and bypass

surgery.

Stent placement

The most common approach to relieving a blocked bile duct does not involve actual surgery. Instead, a stent (small tube, usually made of metal) is put inside the duct to keep it open. This is usually done through an endoscope (a long, flexible tube) while you are sedated. Often this is part of an endoscopic retrograde cholangiopancreatography (ERCP). The doctor passes the endoscope down the throat and all the way into the small intestine. The doctor can then insert the stent into the bile duct through the endoscope. The stent can also be put in place through the skin during a percutaneous transhepatic cholangiography (PTC). (These tests are described in Tests for Pancreatic Neuroendocrine Tumor[6].)

The stent helps keep the bile duct open even if the surrounding cancer presses on it. But after several months, the stent may become clogged and may need to be cleared or replaced. Larger stents can also be used to keep parts of the small intestine open if they are in danger of being blocked by the cancer.

A bile duct stent can also be put in to help relieve jaundice before curative surgery is done (which would typically be a couple of weeks later). This can help lower the risk of complications from surgery.

Bypass surgery

In people who are healthy enough, another option for relieving a blocked bile duct is surgery to reroute the flow of bile from the common bile duct directly into the small intestine, bypassing the pancreas. This typically requires a large incision (cut) in the abdomen, and it can take weeks to recover from this. Sometimes surgery can be done through several small cuts in the abdomen using special long surgical tools. (This is known as *laparoscopic* or *keyhole surgery*.)

Having a stent placed is often easier and the recovery is much shorter, which is why this is done more often than bypass surgery. But this surgery can have some advantages:

- It can often give longer-lasting relief than a stent, which might need to be cleaned out or replaced.
- It might be an option if a stent can’t be placed for some reason.
- During surgery, the surgeon may be able to cut some of the nerves around the pancreas or inject them with alcohol. This may reduce or get rid of any pain caused by the cancer.

Sometimes, the end of the stomach is disconnected from the duodenum (the first part of the small intestine) and attached farther down the small intestine during this surgery as well. (This is known as a *gastric bypass*.) This is done because over time the cancer might grow large enough to block the duodenum, which can cause pain and vomiting and often requires urgent surgery. Bypassing the duodenum before this happens can sometimes help avoid this.

Bypass surgery can still be a major operation, so it's important that you are healthy enough to withstand it and that you talk with your doctor about the possible benefits and risks before you have the surgery.

Surgery for cancer that has spread

Surgery may be used to remove metastases if a pancreatic NET has spread to the liver (the most common site of spread) or the lungs. Surgically removing metastases can improve symptoms and help patients with pancreatic NETs live longer. In rare cases, a liver transplant might be used to treat pancreatic NETs that have spread to the liver.

More information about Surgery

For more general information about surgery as a treatment for cancer, see Cancer Surgery[7].

To learn about some of the side effects listed here and how to manage them, see Managing Cancer-related Side Effects[8].

Hyperlinks

1. www.cancer.org/cancer/pancreatic-neuroendocrine-tumor/detection-diagnosis-staging/net-staging.html
2. www.cancer.org/cancer/pancreatic-neuroendocrine-tumor/detection-diagnosis-staging/how-diagnosed.html
3. www.cancer.org/cancer/pancreatic-neuroendocrine-tumor/detection-diagnosis-staging/how-diagnosed.html
4. www.cancer.org/cancer/cancer-basics/lymph-nodes-and-cancer.html
5. www.cancer.org/cancer/pancreatic-neuroendocrine-tumor/about/new-research.html
6. www.cancer.org/cancer/pancreatic-neuroendocrine-tumor/detection-diagnosis-staging/how-diagnosed.html

7. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery.html
8. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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Ablation or Embolization Treatments for

Pancreatic Neuroendocrine Tumor

Ablation and embolization treatments are different ways of destroying tumors, rather than removing them with surgery.

When might one of these treatments be used?

Ablation or embolization can sometimes be used to help treat pancreatic neuroendocrine tumor (NET) that has spread to other organs, especially the liver. When pancreatic NETs have spread to other sites, these treatments can often reduce tumor size and improve symptoms. But these treatments are very unlikely to cure cancers on their own. They are more likely to be used to help prevent or relieve symptoms, and are often used along with other types of treatment.

Ablative treatments (ablation)

Ablation refers to treatments that destroy tumors, usually with extreme heat or cold. They are generally best for tumors no more than about 2 cm (a little less than an inch) across. There are different kinds of ablative treatments:

- **Radiofrequency ablation (RFA)** uses high-energy radio waves. A thin, needle-like probe is put through the skin and into the tumor. Placement of the probe is guided by an ultrasound or CT scan. The tip of the probe releases a high-frequency electric current which heats the tumor and destroys the cancer cells.
- **Microwave thermotherapy** is similar to RFA, except it uses microwaves to heat and destroy the cancer cells.
- **Ethanol (alcohol) ablation** (also known as *percutaneous ethanol injection*) kills the cancer cells with concentrated alcohol injected directly into the tumor. This is usually done using a needle through the skin, guided by ultrasound or CT scans.
- **Cryosurgery** (also known as *cryotherapy* or *cryoablation*) destroys a tumor by freezing it with a thin metal probe. The probe is guided through the skin and into the tumor using an ultrasound. Then very cold gasses are passed through the probe to freeze the tumor, killing the cancer cells. This method may be used to treat larger tumors than the other ablation techniques, but it sometimes requires general anesthesia (where you are asleep).

Side effects of ablation treatments

Possible side effects after ablation therapy include abdominal pain, infection, and bleeding inside the body. Serious complications are uncommon, but they are possible.

Embolization

During embolization, substances are injected into an artery to try to block the blood flow to cancer cells, causing them to die. This may be used for larger tumors (up to 5cm or 2 inches across) in the liver.

There are 3 main types of embolization:

- **Arterial embolization** (also known as *trans-arterial embolization* or *TAE*) involves putting a catheter (a thin, flexible tube) into an artery through a small cut in the inner thigh and threading it up into the hepatic artery feeding the tumor. Blood flow is blocked (or reduced) by injecting materials to plug up that artery. Most of the healthy liver cells will not be affected because they get their blood supply from a different blood vessel, the portal vein.
- **Chemoembolization** (also known as *trans-arterial chemoembolization* or *TACE*) combines embolization with chemotherapy. Most often, this is done by using tiny beads that give off a chemotherapy drug during the embolization. TACE can also be done by giving chemotherapy through the catheter directly into the artery, then plugging up the artery.
- **Radioembolization** combines embolization with radiation therapy.In the United States, this is done by injecting small radioactive beads (called *microspheres*) into the hepatic artery. The beads lodge in the blood vessels near the tumor, where they give off small amounts of radiation to the tumor site for several days. Since the radiation travels a very short distance, its effects are limited mainly to the tumor.

Side effects of embolization

Possible complications after embolization include abdominal pain[1], fever[2], nausea[3], infection[4], and blood clots in nearby blood vessels. Serious complications are not common, but they can happen.

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/pain.html

2. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/fever.html
3. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/nausea-and-vomiting.html
4. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/low-blood-counts/infections.html

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Radiation Therapy for Pancreatic Neuroendocrine Tumor

Radiation therapy uses high-energy rays (such as x-rays) or radioactive particles to kill cancer cells.

Surgery is the main treatment for most pancreatic neuroendocrine tumors (NETs), but radiation therapy may be an option for those who can't have surgery for some reason. It may also be given after surgery in some cases if there's a chance some of the tumor was not removed and is causing problems. Radiation is sometimes used to treat pancreatic NETs that have spread to the bone and are causing pain. It may also be used in the form of radioembolization to treat NETs that have spread to the liver. (See Ablation or Embolization Treatments for Pancreatic Neuroendocrine Tumor.)

External beam radiation therapy

External beam radiation therapy[1] uses a machine that delivers a beam of radiation to a specific part of the body.

Before your treatment starts, the radiation team will determine the correct angles for aiming the radiation beams and the proper dose of radiation. The treatment is much like getting an x-ray, but the radiation is stronger. The procedure itself is painless. Each treatment lasts only a few minutes, although the setup time – getting you into place for treatment – usually takes longer. Most often, radiation treatments are given 5 days a week for several weeks, but this can vary based on the reason it's being given.

Some common side effects of radiation therapy include:

- Skin changes in areas getting radiation, ranging from redness to blistering and peeling
- Nausea and vomiting
- Diarrhea
- Fatigue
- Loss of appetite
- Weight loss
- Low blood counts, which can increase the risk of serious infection.

Usually these side effects go away within a few weeks after the treatment is complete. Ask your doctor what side effects to expect and how to prevent or relieve them.

Radioactive drugs

Radioembolization

Radioembolization combines embolization with radiation therapy and can be used to treat liver metastases. Small beads called *microspheres* are attached to a radioactive element called *yttrium-90* (or *90Y*) and then injected into an artery close to the liver.The beads travel in the liver blood vessels until they get stuck in small blood vessels near the tumor. There they give off radioactivity for a short while, killing nearby tumor cells. The radiation travels a very short distance, so its effects are limited mainly to the tumor.

Peptide receptor radionuclide therapy (PRRT)

People with somatostatin receptor-positive neuroendocrine tumors may be candidates for PRRT. In PRRT, a radioactive element is linked to a small part (peptide) of a somatostatin analog, and injected into a vein in the arm. The drug travels throughout the body, attaches to the somatostatin receptor (a protein) on the cancer cell, and gives off radiation to kill it. The radiation is delivered directly to the tumor, so there is less effect on healthy tissue. There are several drugs that might be used:

- The radioactive element **Yttrium-90**
- The radioactive element **Lutathera (lutetium or Lu-177 dotatate)**

If you are already taking octreotide or lantreotide, you will most likely need to stop taking these medicines for a certain time before you can be treated with PRRT.

Common side effects of PRRT include low levels of white blood cells, abnormal liver tests, nausea and vomiting, high levels of blood sugar, and pain.

Serious side effects include low levels of blood cells, development of certain blood or bone marrow cancers, kidney damage, liver damage, abnormal levels of hormones in the body, and infertility. Tell your cancer care team if you are pregnant or might become pregnant, because Lu-177 dotatate can harm the baby. There is not enough information regarding Yttrium-90 in pregnant women so you should discuss this with your doctor.

Since these drugs expose you to radiation, people who might come into contact with you need to follow certain radiation safety practices to limit their exposure. See Systemic Radiation Therapy[2] for more information.

More information about radiation therapy

To learn more about how radiation is used to treat cancer, see Radiation Therapy[3].

To learn about some of the side effects listed here and how to manage them, see Managing Cancer-related Side Effects[4].

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation/external-beam-radiation-therapy.html
2. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation/systemic-radiation-therapy.html
3. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation.html
4. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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Chemotherapy for Pancreatic Neuroendocrine Tumor

Chemotherapy (chemo) uses anti-cancer drugs injected into a vein or taken by mouth to kill cancer cells. These drugs enter the bloodstream and reach almost all areas of the body, making this treatment useful for some types of cancers that have spread.

Chemo is most often used to treat pancreatic neuroendocrine tumors (NETs) if they:

- Have not responded to other medicines (such as somatostatin drugs or targeted therapy),
- Have spread to other organs,
- Are large or growing quickly,
- Are causing severe symptoms, **or**
- Are high grade (grade 3)

The most commonly used drugs for pancreatic NETs include:

- Doxorubicin (Adriamycin)
- Streptozocin
- Fluorouracil (5-FU)

- Dacarbazine (DTIC)
- Temozolomide (Temodar)
- Capecitabine (Xeloda)
- Oxaliplatin (Eloxatin)

Some tumors might be treated with more than one drug. Possible combinations include:

- Doxorubicin plus streptozocin
- 5-FU plus doxorubicin plus streptozocin
- Temozolomide plus capecitabine
- 5-FU plus streptozocin

How is chemotherapy given?

Chemo drugs are typically given into a vein (IV), either as an injection over a few minutes or as an infusion over a longer period of time. This can be done in a doctor's office, chemotherapy clinic, or in a hospital setting.

Doctors give chemo in cycles, with each period of treatment followed by a rest period to give you time to recover from the effects of the drugs. Cycles are most often 2 or 3 weeks long. The schedule varies depending on the drugs used. For example, with some drugs, the chemo is given only on the first day of the cycle. With others, it is given for a few days in a row, or once a week. Then, at the end of the cycle, the chemo schedule repeats to start the next cycle.

The length of treatment for advanced pancreatic NETs is based on how well it is working and what side effects you have.

Possible side effects of chemotherapy

Chemo drugs attack cells that are dividing quickly, which is why they work against cancer cells. But other cells in the body, such as those in the bone marrow (where new blood cells are made), the lining of the mouth and intestines, and the hair follicles, also divide quickly. These cells are also likely to be affected by chemo, which can lead to side effects.

The side effects of chemo depend on the type and dose of drugs given and the length of time they are taken. Common side effects can include:

- Nausea and vomiting
- Loss of appetite
- Hair loss
- Mouth sores
- Diarrhea or constipation
- Increased chance of infections (from having too few white blood cells)
- Easy bruising or bleeding (from having too few blood platelets)
- Fatigue (from having too few red blood cells)

Most side effects go away after treatment is finished. Tell your cancer care team about any side effects or changes you notice while getting chemotherapy, so that they can be treated promptly. Often medicines can help prevent or minimize many of the side effects. For example, your doctor can prescribe drugs to help prevent or reduce nausea and vomiting. In some cases, the doses of the chemo drugs might need to be lowered or treatment might need to be delayed or stopped to keep the effects from getting worse.

More information about chemotherapy

For more general information about how chemotherapy is used to treat cancer, see Chemotherapy[1].

To learn about some of the side effects listed here and how to manage them, see Managing Cancer-related Side Effects[2].

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html
2. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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Targeted Therapy for Pancreatic Neuroendocrine Tumor

Targeted drugs work differently from standard chemo drugs. These drugs target specific parts of cancer cells. They are sometimes helpful when chemotherapy is not and often have different side effects than chemotherapy.

The targeted drugs used to treat pancreatic neuroendocrine tumors (NETs) work by blocking angiogenesis (the growth of new blood vessels that nourish cancers) or important proteins (called *tyrosine kinases*) in cancer cells that help them grow and survive.

Sunitinib (Sutent)

Sunitinib blocks several tyrosine kinases and attacks new blood vessel growth. It has been shown to help slow tumor growth. This drug is taken as a pill once a day.

The most common side effects are nausea, diarrhea, changes in skin or hair color, mouth sores, weakness, and low blood cell counts. Other possible effects include tiredness, high blood pressure, heart problems, bleeding, hand-foot syndrome (redness, pain, and skin peeling of the palms of the hands and the soles of the feet), and low thyroid hormone levels.

Everolimus (Afinitor)

Everolimus blocks a protein known as *mTOR*, which normally helps cells grow and divide. It has been shown to help treat advanced pancreatic NETs. Everolimus is a pill taken once a day.

Common side effects of this drug include mouth sores, infections, nausea, loss of appetite, diarrhea, skin rash, feeling tired or weak, fluid buildup (usually in the legs), and increases in blood sugar and cholesterol levels. A less common but serious side effect is damage to the lungs, which can cause shortness of breath or other problems.

More information about targeted therapy

To learn more about how targeted drugs are used to treat cancer, see Targeted Cancer Therapy[1].

To learn about some of the side effects listed here and how to manage them, see Managing Cancer-related Side Effects[2].

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/targeted-therapy.html
2. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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Other Drugs for Pancreatic Neuroendocrine Tumors

For people with advanced pancreatic neuroendocrine tumors (NETs), several medicines can help control symptoms and tumor growth. These drugs are used mainly when the tumor can't be removed with surgery.

Somatostatin analogs

Somatostatin analogs are related to somatostatin, a natural hormone in the body. They can help slow the growth of neuroendocrine tumor cells. They can be very helpful for some patients with pancreatic NETs because these drugs stop tumors from releasing hormones into the bloodstream, which can often relieve symptoms and help patients feel better. They also seem to help slow the growth of some tumors, but cannot cure them.

These drugs can help reduce diarrhea in patients with VIPomas, glucagonomas, and somatostatinomas, help the rash of glucagonomas, and lower the levels of insulin in insulinomas. They are very useful in people who have carcinoid syndrome[1] (facial flushing, diarrhea, wheezing, rapid heart rate), although this syndrome is not as common with NETs in the pancreas as it is with NETs found in other places. The drugs are also helpful for people whose tumors show up on a somatostatin receptor scintigraphy (SRS) scan or gallium-68 Dotatate scans.

- **Octreotide (Sandostatin):** One version of octreotide is short-acting and is injected 2 to 4 times a day under the skin. There is also a long-acting form of the drug (called Sandostatin LAR Depot) that only needs to be given once a month, by injection into a muscle. Depending on the severity of symptoms, some people are given injections every day when first starting treatment. Once symptoms are controlled, the longer-acting monthly injection may then be used. Other times, the long acting drug may be started from the beginning.
- **Lanreotide (Somatuline Depot):** This somatostatin analog is injected under the skin about once a month.

Either drug may be given by your doctor or nurse, or you may learn how to give the injection at home.

Possible side effects

The main side effects of these drugs are pain at the site of the injection, and rarely, stomach cramps, nausea, vomiting, headaches, dizziness, and fatigue. These drugs can also cause sludge to build up in the gallbladder, which can lead to gallstones. They can also make the body resistant to the action of insulin, which can raise blood sugar levels and make pre-existing diabetes harder to control. As a result, these drugs are only used to treat insulinomas if the tumor has somatostatin receptors as seen by a positive somatostatin receptor scintigraphy (SRS) or gallium-68 Dotatate scan.

Other drugs used for specific pancreatic NETs

Somatostatin analogs can be used to treat most pancreatic NETs. But other drugs may be added to treat specific symptoms or problems that are caused by the excess hormone being produced by the cancer.

Gastrinomas make too make gastrin, which increases stomach acid levels, and can lead to stomach ulcers. Proton pump inhibitors, for example omeprazole (Prilosec), esomeprazole (Nexium), or lansoprazole (Prevacid), block stomach acid production and may be given to decrease the chance of ulcers forming.

Insulinomas make too much insulin which causes very low blood glucose (sugar) levels. If the somatostatin receptor scintigraphy (SRS) or gallium-68 Dotatate scans are negative, showing the cancer does not have the somatostatin protein, then other treatments besides somatostatin analogs are considered to even out glucose levels. Diazoxide, a drug that keeps insulin from being released into the bloodstream, or diet changes (higher carbohydrate intake or more frequent meals) may be started to raise glucose levels.

Glucagonomas make too much glucagon, a hormone that increases blood glucose (sugar) levels. It works opposite of insulin. These cancers may be treated with medicines for diabetes if somatostatin analogs alone are not enough to control the high glucose levels.

VIPomas make too much vasoactive intestinal peptide (VIP), a hormone that regulates water and mineral (such as potassium and magnesium) levels in the gut. Treatment may involve giving intravenous (IV) fluids to treat the dehydration from diarrhea as well as certain minerals that are low.

Hyperlinks

1. www.cancer.org/cancer/gastrointestinal-carcinoid-tumor/detection-diagnosis-staging/signs-symptoms.html

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Treating Pancreatic Neuroendocrine Tumor, Based on Extent of the Tumor

Treatment of pancreatic neuroendocrine tumors (NETs) depends to a large extent on whether they can be resected (removed) completely or not. But other factors, such as your overall health, can also affect treatment options. Talk to your doctor if you have any questions about the treatment plan he or she recommends.

Sometimes it can be hard to determine if cancer is resectable – that is, if it can be removed completely – using just imaging tests[1]. A laparoscopy might be done before surgery to help determine if the tumor can be removed. But even then, cancers sometimes turn out to have spread farther than was first thought.

Pancreatic NETs are more likely to be resectable than exocrine pancreas cancers[2] (the most common type of pancreatic cancer). Most NETs that have not spread to distant parts of the body are resectable. Even some NETs that have spread might be resectable if they have not spread too far (such as only to a few spots in the liver).

Treating resectable tumors

If the tumor is resectable, surgery[3] will be recommended. The procedure used depends on the type of tumor, its size, and its location in the pancreas. Surgery can range from as little as enucleation (removing just the tumor) to as much as a Whipple procedure (pancreaticoduodenectomy). Lymph nodes are often removed to check for tumor spread.

Before any surgery, medicines are often given to control any symptoms caused by the tumor. For example, drugs to block stomach acid (like proton pump inhibitors) are used for gastrinomas. Often, people with insulinomas are treated with diazoxide to keep blood sugar from getting too low. If the tumor was visible on somatostatin receptor scintigraphy[4], a somatostatin analog such as octreotide may be used to control any symptoms.

Surgery alone is all that is needed for many pancreatic NETs, but after surgery, close monitoring is important to look for signs that the cancer may have come back or spread.

Treating unresectable tumors

Unresectable tumors can’t be removed completely with surgery. Pancreatic NETs are

often slow growing, so lab and imaging tests are used to monitor the tumor(s) and look for signs of growth.

People with NETs that have spread outside the pancreas often have symptoms like diarrhea or hormone problems. These can often be helped with medicines like octreotide, lanreotide, diazoxide, and proton pump inhibitors. Some of these might also slow the growth of the tumor.

If further treatment is needed, chemotherapy or targeted drugs (such as sunitinib or everolimus) might be used, but this is usually delayed until a person is having symptoms that can't be controlled with other drugs or has signs of tumor growth on scans. Surgery or ablative techniques[5] might also be used to treat cancer spread to the liver.

For people with poorly differentiated tumors (neuroendocrine carcinomas), chemotherapy is typically the first treatment.

For adults with somatostatin (a type of hormone) receptor-positive pancreatic neuroendocrine tumors, a radiopharmaceutical drug, called Lutathera (lutetium Lu 177 dotatate), is also an option for treatment.

If treatment is no longer working at some point, you might want to think about taking part in a clinical trial[6] testing a newer treatment. While these are not always the best option for every person, they may benefit you as well as future patients.

The treatment information given here is not official policy of the American Cancer Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor. Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

Hyperlinks

1. /content/cancer/en/cancer/pancreaticcancer/detailedguide/pancreatic-cancer-diagnosis.html
2. www.cancer.org/cancer/pancreatic-cancer.html
3. /content/cancer/en/cancer/pancreaticcancer/detailedguide/pancreatic-cancer-treating-surgery.html
4. /content/cancer/en/cancer/pancreaticcancer/detailedguide/pancreatic-cancer-diagnosis.html

5. /content/cancer/en/cancer/pancreaticcancer/detailedguide/pancreatic-cancer-treating-ablative-techniques.html
6. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

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