

## Patient information from the BMJ Group

# Parkinson's disease

In this section

[What is it?](#)

[What are the symptoms?](#)

[How is it diagnosed?](#)

[How common is it?](#)

[What treatments work?](#)

[What will happen?](#)

[Questions to ask](#)

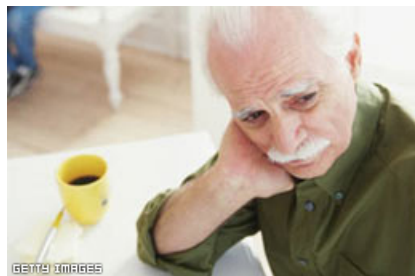
## Parkinson's disease

It can come as a shock to find out that you or someone close to you has Parkinson's disease. But your symptoms may not bother you for several years. When they do, there are treatments that can help.

We've brought together the best research about Parkinson's disease and weighed up the evidence about how to treat it. You can use our information to talk to your doctor and decide which treatments are best for you.

## What is Parkinson's disease?

Parkinson's disease affects how you move.



If you or someone close to you has been diagnosed with Parkinson's disease, you're probably worried about the future.

An early sign is a slight trembling in one hand. Over time, you start doing things more and more slowly as your muscles become stiff. You may lose your balance more easily.

Some people with Parkinson's live for years with mild symptoms that can be annoying but don't need treatment. But if your symptoms get worse, there are treatments that can help.

## Key points for people with Parkinson's disease

- Parkinson's disease usually starts in people who are over 60.
- The main symptoms are shaking, stiff muscles, slow movements, and poor balance. But you may not get all of these.

## Parkinson's disease

- It can be hard for doctors to diagnose Parkinson's disease. Other conditions have similar symptoms.
- Keeping track of your symptoms is important. If you can describe your symptoms clearly, this will help your doctor find the right treatment for you.

### How your brain helps you move

To understand what happens when you have Parkinson's disease and how it can be treated, it's useful to know something about how your brain works.

Cells deep inside your brain control how and when you move. <sup>[1]</sup>

- These brain cells make **dopamine**. Dopamine is a **neurotransmitter**, a type of chemical that helps messages travel between nerve cells, including your brain cells.
- Brain cells need dopamine to send messages to other parts of your brain, and to nerves and muscles throughout your body.
- Messages deep inside your brain help you move smoothly and do the right thing at the right time. For example, they stop you tripping at the kerb as you step into a road. And they help you move your fingers to tie your shoelaces.

### What happens in Parkinson's disease?

Parkinson's disease happens when the brain cells that make dopamine die or don't work properly. Doctors don't know why this happens. <sup>[2]</sup> With less dopamine, brain cells in some parts of your brain don't send messages properly. This means you can't control your movements in the usual way. The amount of dopamine in your brain has to drop by 80 percent for the signs of Parkinson's disease to show.

### Parkinson's disease: why me?

Doctors don't know why some people get Parkinson's disease and others don't. But there are some things that increase your chances of getting it. Doctors call these risk factors.

If you have a risk factor, this simply means you have a higher chance of getting the disease than someone without the risk factor. It doesn't mean that you will definitely get it.

### Risk factors for Parkinson's disease

The main risk factor for Parkinson's disease is getting older. <sup>[3]</sup>

- Getting older: The average age for symptoms to start is about 65. <sup>[4]</sup> You can get Parkinson's while you're still in your 30s, but this is rare.

## Parkinson's disease

- Being male: Slightly more men than women get Parkinson's. <sup>[4]</sup> But we don't know why.
- Not smoking: If you smoke, you're slightly less likely to get Parkinson's than if you don't. Again, we don't know why this is. <sup>[4]</sup> But no doctor would recommend you start smoking to reduce your chances of getting Parkinson's.
- Having Parkinson's in your family: If your father, mother or one of your brothers or sisters has Parkinson's, you're slightly more likely to get it than someone who doesn't have the disease in his or her family. <sup>[5]</sup> <sup>[6]</sup> Some types of Parkinson's, especially those that appear before the age of 40, may be passed down in your family through genes. <sup>[7]</sup> But this isn't common. Only about 1 in 20 people with Parkinson's have this type of the disease. Parkinson's more often happens in families where no one has had it before.

Doctors have looked at many other things to see whether they might be linked to Parkinson's disease. For example, some research suggests you may be more likely to get Parkinson's if: <sup>[4]</sup>

- You work with pesticides or other chemicals
- You've had a head injury.

But more research is needed to know for certain whether these things increase your risk of Parkinson's.

### What are the symptoms of Parkinson's disease?

Parkinson's disease can affect you in four main ways: shaking, having stiff muscles, having slow movements, and having poor balance. The symptoms are usually mild at first and you may not need any treatment for a while.

Symptoms tend to progress slowly and in no particular order. <sup>[8]</sup> <sup>[9]</sup> Parkinson's disease affects everyone differently, and you probably won't get all of these symptoms.

#### Shaking (doctors call this tremor or resting tremor)

- One of your hands may shake, especially when you're relaxing. But the shaking stops when you're asleep or moving.
- The shaking is worse when your hand is resting or you're stressed.
- Shaking usually affects one side of your body, especially early on in the disease.
- Many people rub their thumb and index finger together as if rolling a pill.

## Parkinson's disease

- As the shaking gets worse, you may not be able to hold a cup or newspaper steady.
- Shaking can also affect your neck, chin, and head.
- Shaking is an important symptom for many people. But about a quarter of people never get it.

### Stiff muscles (doctors call this rigidity)

- Some of your muscles may be tense because they're not getting the right messages from your brain.
- This makes you stiff, and you may find it difficult to move. For example, you may find it difficult to get out of a chair.
- Your face may seem less expressive because the muscles there aren't moving as well as they normally would.
- Your muscles may resist or jerk if someone tries to move part of your body (your arm, for example). Doctors call this **cogwheel rigidity**.

### Slow movements (doctors call this bradykinesia or akinesia)

- You may find it hard to start moving because instructions from your brain take longer to get to your nerves and muscles.
- You may stay in the same position for longer than usual without moving.
- You may have problems moving smoothly. This can be frustrating and unpredictable. You can be moving easily one minute and then suddenly need help.
- Tasks you once did quickly and easily, such as washing and dressing, may take much longer.
- Your handwriting may look spidery and small.

### Poor balance (doctors call this postural instability)

- You may lean forwards or backwards and fall over easily.
- You may have problems walking.
- You may freeze in mid-stride and not be able to take the next step. Doctors call this **freezing of gait** or FOG for short.
- You may take quick, small, shuffling steps. Doctors call this **festination**.

## Parkinson's disease

- You may stop naturally swinging your arms as you walk.

Your symptoms might not be obvious during the early stage of the disease. Your friends or relatives may be the first to notice changes. For example, they may see that your face doesn't light up when you laugh.

As the disease progresses, your symptoms may start to get in the way of what you want to do. For example, you might find it hard to hold a cup steadily.

You may also get other problems, such as depression and trouble swallowing and chewing. See [Problems linked with Parkinson's disease](#) to learn more. Some of these problems may appear early in the disease and some later.

It's important to keep track of your symptoms so that you can tell your doctor how they have changed since your last visit. In fact, you might want to keep a diary of your symptoms to show your doctor.

This information will help a specialist decide when you should start taking medication and when you need to change your treatment. You may see your doctor for many years before they think you should take treatment for Parkinson's disease.

### How do doctors diagnose Parkinson's disease?

There is no test that can tell you whether you have Parkinson's.

To diagnose the disease, your doctor will probably:

- Ask about your symptoms and your health now and in the past
- Examine you to see whether something else could be causing your symptoms.

If you are young, your doctor may do some blood tests to rule out other, rarer diseases.

If your doctor thinks you may have Parkinson's disease, they should refer you to a specialist (this doctor could be a geriatrician or a [neurologist](#)). You should be seen by a specialist before treatment with drugs is started.

The National Institute for Health and Care Excellence (NICE), which advises the government on which treatments work best, says Parkinson's disease must only be diagnosed by a specialist, not by a GP. You should see a specialist within six weeks if your symptoms are mild, or two weeks if your symptoms are severe. <sup>[31]</sup>

### Brain scans

The specialist may recommend you have a brain scan, such as [MRI](#). Scans provide images of the inside of your brain to help your doctor rule out other problems or diseases.

<sup>[32]</sup> <sup>[33]</sup> Different types of brain scan give different information.

## Parkinson's disease

However, guidelines from NICE say that doctors should usually diagnose Parkinson's disease from a person's symptoms, not scans. Scanning may be useful for some people, but scanning is not usually necessary.

### MRI scans

These use magnetism to take pictures of your brain. They are good at showing up damaged areas. The results of these scans can help doctors decide if you have Parkinson's or if you've had something else (like a stroke, for example). You lie still inside the scanner. It looks like a large tube and is quite noisy. Tell the staff if you don't like enclosed spaces as they can help you. For example, they may give you a panic button to hold in your hand during the scan. If you're feeling too panicky to stay in the scanner, you press the button and the staff will let you out.

### PET (Positron Emission Tomography)

These scans use injections of radioactive chemicals to show how well different parts of your brain are working. They can help doctors tell if you have Parkinson's or another brain disease. Having a PET scan doesn't hurt. You'll have a small injection and then wait for the radioactive chemical to get to your brain. You'll then be asked to lie very still in the scanning machine while the pictures are taken. You will only be exposed to a very small amount of radioactivity, and it doesn't last long. So it isn't dangerous.

### SPECT (Single Photon Emission Tomography)

This is very similar to PET, but it uses different radioactive substances.<sup>[34]</sup> These scans can also help doctors decide if you have Parkinson's or something else.<sup>[34]</sup>

Guidelines for doctors from NICE say that doctors should usually diagnose Parkinson's disease from your symptoms. It says that SPECT scanning may be useful for some patients, but that mostly scanning is not necessary.<sup>[31]</sup>

### Being diagnosed

To be diagnosed with Parkinson's disease, you should have slow movement (bradykinesia) and at least one of the following other symptoms:<sup>[31]</sup>

- Shaking (tremor)
- Stiff muscles (rigidity)
- Poor balance (postural instability).

To learn more about these symptoms, see [What are the symptoms of Parkinson's disease?](#)

## Parkinson's disease

Diagnosing Parkinson's in the early stages can be difficult. But it's important to get the right diagnosis. There are many illnesses with symptoms similar to those of Parkinson's, and they are treated differently. See [Diseases that look like Parkinson's](#) to learn more.

You probably don't have Parkinson's if: <sup>[35]</sup>

- Your symptoms don't get any better when you start taking medicine for Parkinson's, such as [levodopa](#) or a [dopamine agonist](#)
- Your movement problems affect both sides of your body in the same way (they are symmetrical)
- Your symptoms get worse quickly
- You have problems with your memory, thinking, or personality early on or before other symptoms start.

NICE guidelines say that everyone who has been diagnosed with Parkinson's disease should be seen by a doctor every six to 12 months, to make sure they definitely have Parkinson's disease. If they get unusual symptoms, doctors should check to see if they might have something other than Parkinson's disease. <sup>[31]</sup>

### How common is Parkinson's disease?

Parkinson's disease is quite common. In the UK about 1 in 500 people have it. <sup>[10]</sup>

- Around 127,000 people in the UK have Parkinson's. <sup>[10]</sup>
- Every year, about 10,000 people in the UK are told they have the disease. <sup>[10]</sup>
- Your chances of getting Parkinson's increase as you get older. Since people are now living longer than ever today, more people are getting the disease.
- Many people with Parkinson's disease, especially those who are very old, are never diagnosed with the disease. This may be because people confuse the symptoms of Parkinson's with the normal signs of ageing. <sup>[10]</sup> So, they don't go to the doctor to have these symptoms checked.

### What treatments work for Parkinson's disease?

Parkinson's disease affects how you move. For example, your hands may shake or your movements get stiff and slow. It's a serious disease but your symptoms may not bother you for several years. When they do, there are treatments that can help.

Parkinson's disease happens when your brain stops making enough of a chemical called **dopamine**. Brain cells need [dopamine](#) to send messages around your brain and to

## Parkinson's disease

nerves and muscles throughout your body. With less dopamine, you can't control your movements in the usual way.

The main treatment for Parkinson's is the drug **levodopa** (also known as L-dopa). Everyone treated for Parkinson's takes levodopa at some point. The drug can work so well that your symptoms may clear up completely for a while.

But treating Parkinson's is complicated. Levodopa has unpleasant side effects that can be permanent. And after a while it may not work as well. Doctors have tried many ways to make levodopa work for longer. So you may take a combination of drugs to control your symptoms. See [How doctors treat Parkinson's disease](#) to learn more.

It's important to describe your symptoms well to your specialist. This will help him or her find the right treatment for you.

### Key messages for treating Parkinson's disease

- Levodopa is the best medicine for controlling the symptoms of Parkinson's. But it can stop working and cause side effects after about five years. The main problem it causes is abnormal movements you can't control, such as head nodding and twitches.
- Younger people should try to put off starting levodopa until their symptoms are really causing problems.
- Drugs called selegiline (brand names Eldepryl and Zelapar) and rasagiline (Azilect) can delay when you need to start taking levodopa. But they can have side effects.
- Drugs called dopamine agonists (brand names Dostinex, Celance, and Parlodel) may help your symptoms, without the same side effects as levodopa. But they can cause side effects, some serious.
- Taking two drugs together can improve your symptoms or reduce the side effects you get. You might take levodopa with a dopamine agonist or with drugs called entacapone (Comtess), tolcapone (Tasmar), or amantadine (Symmetrel, Lysovir). Or you might take a dopamine agonist and add in levodopa. But taking two drugs can make some side effects worse.
- Having a specialist nurse involved in your care can help you cope better with your disease.
- Physiotherapy and other therapies may help to keep you moving and doing things for yourself, but there's not much research.
- Surgery can help some people in the later stages of Parkinson's disease. But the risks are high.



## Parkinson's disease

The National Institute for Health and Care Excellence (NICE), which advises the government on which treatments work best, has made some recommendations about the way people with Parkinson's disease should be treated. To learn more, see [NICE guidelines on Parkinson's disease](#).

### **NICE guidelines on Parkinson's disease**

The National Institute for Health and Care Excellence (NICE), which advises the government on which treatments work best, has looked at all the evidence about how Parkinson's disease should be treated. It's made some recommendations about what sort of treatments should be available. <sup>[37]</sup>

- Doctors should decide which drugs to use after considering people's individual condition, their needs, and their opinions about treatment. There is no one drug that is right for everyone, either in early Parkinson's disease or later on.
- People with Parkinson's disease should see a specialist regularly, to see how well their medicines are working. When you first start taking medicines, this should be every two to three months.
- Everyone with Parkinson's disease should have a health care professional who can support them, provide information, and visit them at home if necessary. This may be a specialist nurse.

In addition, everyone with Parkinson's disease should be offered the following types of therapy, to help them cope with their symptoms: <sup>[37]</sup>

- **Physiotherapy**, to help with problems walking and problems getting exercise
- Occupational therapy, to help with everyday activities including work, social life, and personal care
- Speech and language therapy.

To read more, you can see [the full guideline](#) or [a version of the guideline for patients and carers](#).

Which treatments work best? We've looked at the research and given each treatment a rating according to how well it works.

For more help in deciding which treatment is best for you, see [How to make the best decisions about treatment](#).

## Treatment Group 1

### Treatment of Parkinson's disease

#### Treatments that work

- [Levodopa](#) : Levodopa is the best drug for controlling the symptoms of Parkinson's. [More...](#)

#### Treatments that are likely to work

- [Being cared for by a specialist nurse](#) : A nurse with training in looking after people with Parkinson's disease helps you understand the condition and how it's treated. They will also monitor your treatment and organise your care. For example, if you need to see a physiotherapist the nurse will make you an appointment. [More...](#)
- [Levodopa plus amantadine](#) : If you're taking levodopa, your doctor might add amantadine to your treatment. [More...](#)

#### Treatments that work, but whose harms may outweigh benefits

- [Selegiline and rasagiline](#) : These drugs may be used in the early stages of Parkinson's to delay the need for levodopa. Brand names for selegiline are Eldepryl and Zelapar. The brand name for rasagiline is Azilect. [More...](#)
- [Dopamine agonists](#) : These are drugs that work like dopamine does in your brain. Some examples of dopamine agonists (and their brand names) are cabergoline (Dostinex), ropinirole (Requip), and pramipexole (Mirapexin). [More...](#)
- [Adding levodopa to a dopamine agonist](#) : If you're already taking a dopamine agonist, your doctor might add levodopa to your treatment. [More...](#)
- [Adding a dopamine agonist to levodopa](#) : If you're already taking levodopa, your doctor might add a dopamine agonist to your treatment. [More...](#)
- [Levodopa plus entacapone or tolcapone](#) : If you're taking levodopa, your doctor might recommend you take entacapone (brand name Comtess) or tolcapone (Tasmar) as well. [More...](#)
- [Pallidotomy](#) : This is surgery on a part of your brain known as the globus pallidus. A pallidotomy destroys overactive brain cells in this area. [More...](#)
- [Pallidal deep brain stimulation](#) : This temporarily stuns the brain cells in a part of your brain known as the globus pallidus. [More...](#)
- [Subthalamic deep brain stimulation](#) : This surgery temporarily stuns the brain cells in a part of your brain called the subthalamic nucleus. [More...](#)

# Parkinson's disease

## Treatments that need further study

- [Amantadine](#) : This drug is sometimes used in the early stages of Parkinson's disease to treat shaking (tremor). The brand names are Symmetrel and Lysovir. [More...](#)
- [Thalamic surgery](#) : This is surgery on a part of your brain known as the thalamus. A thalamotomy destroys brain cells in this area. Thalamic deep brain stimulation temporarily stuns the brain cells. [More...](#)
- [Subthalamotomy](#) : This is surgery on a part of your brain. It destroys overactive brain cells. [More...](#)
- [Physiotherapy](#) : This therapy uses exercises to help you move better and do more things. [More...](#)
- [Occupational therapy](#) : A therapist teaches you ways to adapt to your symptoms so you can do activities that are important to you. [More...](#)
- [Speech and language therapy](#) : If you have trouble speaking in the later stages of Parkinson's, a therapist can help you retrain your voice so that people can better understand what you say. [More...](#)
- [Swallowing therapy](#) : A therapist teaches you exercises to make your swallowing muscles stronger so that you can swallow more easily. [More...](#)

## Other treatments

We haven't looked at the research on these treatments in the same detail we have for the other treatments we cover. (To read more, see Our method.) But we wanted to cover these treatments because you may have questions about them.

- [Anticholinergic drugs](#) : These drugs block the activity of a substance in the body called acetylcholine. [More...](#)
- [Other types of brain surgery](#) : There are several types of brain surgery for Parkinson's disease. We cover some of these in detail elsewhere (see [Pallidotomy](#) , [Pallidal deep brain stimulation](#) , [Subthalamic deep brain stimulation](#) , [Thalamic surgery](#) , and [Subthalamotomy](#) ). Newer operations include gamma knife surgery, cell transplants, and glial cell line derived neurotrophic factor (GDNF) surgery. [More...](#)

## What will happen to me?

No one can say for certain what will happen to you if you have Parkinson's disease. Everyone is different, and the way the disease affects you may be different from the way it affects someone else.

## Parkinson's disease



Staying active can help you cope with the symptoms of Parkinson's and may even help slow down the disease.

Some people hardly notice their symptoms in the early stages of Parkinson's and lead a full life for many years.

But symptoms usually get worse as time goes on and your brain makes less and less of the neurotransmitter **dopamine** . For more information, see [What is Parkinson's disease?](#)

There's no cure for Parkinson's disease. But there are treatments that work well. Some work so well that you may forget about your symptoms for a while. For more information, see [What treatments work for Parkinson's disease?](#)

But the disease will eventually progress, and the drugs might not work as well when this happens.<sup>[1]</sup> You might have to make decisions about when to start treatment, and whether to have more than one treatment at once. To read more, see [How doctors treat Parkinson's disease](#) .

You may also get other problems because of Parkinson's disease. For example, you might feel depressed, find it hard to get to sleep, or have problems chewing and swallowing. For more information, see [Problems linked with Parkinson's disease](#) .

These problems can be treated with drugs or sometimes with other kinds of therapy. For example, if the muscles in your face are stiff and make speaking difficult, [speech and language therapy](#) can help you adapt the way you talk.

Many people want to know how they will be in two or three years' time. But the truth is that no one can say for certain. Science and medicine change all the time as we find out

## Parkinson's disease

new things about how the brain works. In the next few years, new drugs or surgery may become available that we know very little about today.

The important thing is to keep positive. There's a lot you can do to stay healthy. <sup>[10]</sup>

- Exercise: regular exercise can improve your balance and coordination. <sup>[17]</sup> It can also stop you from feeling depressed and help with constipation.
- Attend support groups: you can get advice and emotional support by meeting other people with Parkinson's and their care givers.
- Stay active: it seems to help people with Parkinson's to keep doing the things they enjoy.

If you're caring for someone with Parkinson's disease, you may need support too. <sup>[15]</sup> If you feel you can't cope or you get depressed, see your GP. They may be able to put you in touch with local support groups and organisations that offer help in the home.

### Questions to ask your doctor

Being diagnosed with a serious illness like Parkinson's often comes as a shock. You may find it hard to think of everything you want to ask your doctor.

It might help to make a list of questions before your appointment. You could also take notes during your visit, or bring a close friend or relative with you to ask questions and jot down information.

Here are some questions you may want to ask.

- Have I definitely got Parkinson's disease? Or could my symptoms be caused by something else?
- I'd like to see a specialist. Can you recommend a doctor who specialises in Parkinson's disease?
- Will my symptoms get worse?
- What drugs can I take to ease my symptoms?
- What drug can I take to delay starting [levodopa](#) ?
- Do the drugs have side effects?
- What can I do to reduce the side effects of the drugs?
- Could surgery help me?

## Parkinson's disease

- What are the risks of surgery?
- Could **physiotherapy** help me?
- Could occupational therapy help me?
- Could speech therapy help me?
- Does Parkinson's run in my family? Will other people in my family get Parkinson's disease?

If you are caring for someone with Parkinson's disease, you may want to ask these questions on that person's behalf. You should also ask what kind of help and support you can expect from health care professionals. You shouldn't have to cope alone.

---

### Treatments:

#### Levodopa

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on levodopa?](#)

This information is for people who have Parkinson's disease. It tells you about levodopa, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

#### Does it work?

Yes. Levodopa can help with the symptoms of Parkinson's. But after a few years, people who take levodopa get problems that can be worse than their Parkinson's symptoms.

For this reason, doctors don't like to prescribe levodopa for people with early Parkinson's disease. They tend to use it only when someone's symptoms cause serious problems. See [How doctors treat Parkinson's disease](#) to learn more.

Levodopa improves Parkinson's symptoms more than [dopamine agonists](#) do.

#### What is it?

Levodopa is found naturally in plants and animals. Laboratories also make it, for use in medicine. Nerve cells in the brain can use levodopa to make **dopamine**, a chemical that sends messages within your brain and to nerves and muscles throughout your body. Levodopa helps people with Parkinson's, since they don't have enough **dopamine**.

There are a few ways to take levodopa.

## Parkinson's disease

- You'll probably be given levodopa with another drug called carbidopa or benserazide. <sup>[21]</sup> The combination of levodopa and carbidopa is called co-careldopa (the brand name is Sinemet). The combination of levodopa and benserazide is called co-beneldopa (the brand name is Madopar). Carbidopa and benserazide prevent levodopa being changed into dopamine before it reaches your brain. These extra substances reduce the side effects of levodopa and the amount of levodopa you need to take.
- You can also take co-careldopa and co-beneldopa as extended-release and controlled-release tablets or capsules. If you take these types of levodopa, you may not need to take tablets as often because the levodopa is released gradually into your body over a few hours.
- Madopar also comes in tablets that can be dissolved in water or orange squash (but not orange juice). You can use these to give you a kick start in the morning, because the drug gets absorbed quicker than when you take the usual tablets. It's also useful if you're having problems swallowing tablets or capsules.
- Your doctor may also tell you to take levodopa only when your symptoms are bad. This way, you use less than if you took a tablet, for example, every four hours. When you take levodopa this way, it's called rescue levodopa.

Levodopa works so well that some people forget they have Parkinson's. <sup>[18]</sup> But levodopa is not a cure. Although it can reduce symptoms, it does not replace lost brain cells. Levodopa does not stop your disease from getting worse.

### How can it help?

Levodopa can help in the following ways.

- Levodopa relieves most symptoms of Parkinson's straight away. <sup>[38]</sup>
- Experts say it is the best drug available for treating Parkinson's disease. <sup>[39]</sup>
- Ordinary levodopa tablets work just as well as extended-release and controlled-release tablets. <sup>[22]</sup> <sup>[23]</sup>

### How does it work?

People with Parkinson's disease have less dopamine in their brain than people who don't have the disease. This is because the brain cells that should make **dopamine** have died or don't work as well. A lack of dopamine leads to Parkinson's symptoms, such as moving slowly and clumsily. (To learn more, see [What is Parkinson's disease?](#) )



## Parkinson's disease

Unfortunately, you can't take dopamine tablets, because dopamine is not able to pass from your bloodstream into your brain. But if you take levodopa, this gets into your brain and is changed into dopamine by your brain cells.<sup>[21]</sup> The extra dopamine then reduces the symptoms of Parkinson's, such as shaking, stiff muscles, and slow movement.

Levodopa is usually combined with carbidopa or benserazide. These substances stop your body from using up the levodopa before it reaches your brain. This means you won't need to take as much levodopa, which reduces your risk of side effects.

### Can it be harmful?

Yes. After taking levodopa for two to five years, about half of all people get serious side effects.<sup>[40]</sup> The younger you are when you start taking levodopa, and the more levodopa you take, the more likely you are to get the following problems.<sup>[38] [23] [41]</sup>

- **Wearing off.** This happens when your levodopa dose becomes less effective, so it wears off more quickly. For example, you may notice your symptoms are worse than they used to be before your first dose in the morning. Your muscles might also start to stiffen or your hands might start to tremble before your next dose is due.
- **On-off effect.** Your symptoms may come back and go away suddenly. When your symptoms come back, this is called 'off time'. Off times may last a few minutes or hours. When your symptoms go away, this is called 'on time'. People who look after someone with Parkinson's say the effect is like a light being switched on and off. One minute the person is joining in with conversation and other people, and the next minute they freeze and go quiet. Off times can happen several times a day. They are not related to when you take your medicine.
- **Movements you can't control.** These can happen just before or after you take your dose of levodopa, or midway between two doses. You may nod your head over and over again. Or you may jerk your leg, smack your lips, or make a strange face. You may also move your body into strange positions. Doctors call these movements dyskinesias (abnormal jerking movements) and dystonia (a type of movement problem that causes abnormal twisting and body positions).

Doctors aren't sure what causes these side effects. It could be that the brain can no longer store dopamine as it used to.<sup>[21]</sup> Some experts have also suggested that levodopa could damage nerves in the brain, but studies have not proved this.

However, it's wise to delay starting levodopa for as long as you can. By using other drugs to help your symptoms first, you won't take levodopa for as long a time. This can reduce your chances of getting problems from the drug. To learn more, see [How doctors treat Parkinson's disease](#).

Other problems you might get while taking levodopa are:<sup>[23]</sup>

- Nausea and vomiting



## Parkinson's disease

- Dizziness
- Sleep problems
- Stomach pain
- Headache
- Feeling agitated
- Depression.

You may also:

- Feel very sleepy. You shouldn't drive if you find yourself dozing off in unusual situations <sup>[42]</sup>
- Notice that your urine has a reddish colour, but this is harmless and nothing to worry about.

A report from Europe says that levodopa, especially when taken with a dopamine agonist, may be linked to certain compulsive disorders. <sup>[43]</sup> A compulsive disorder is when you have an urge to do something and it's difficult to control. Compulsive disorders often cause problems in people's life. Dopamine agonists and levodopa have been linked to:

- Compulsive gambling
- Compulsive sexual behaviour.

### How good is the research on levodopa?

There hasn't been much research on levodopa on its own to treat people with Parkinson's disease. This is because doctors know that it works. So it would be unfair to conduct a study in which some people were treated with a dummy tablet (a placebo) rather than a drug that would help them.

We found only one study that compared people taking levodopa with people given a dummy treatment (a placebo) in the early stages of Parkinson's. <sup>[44]</sup> People who took levodopa had: <sup>[44]</sup>

- Fewer symptoms. The highest dose (600 milligrams daily) worked best. But people who took the highest dose also had more side effects (abnormal jerking movements known as dyskinesias)
- Less difficulty moving around

## Parkinson's disease

- Fewer problems with daily tasks.

### Types of levodopa

There's no evidence that extended-release and controlled-release levodopa works any better than immediate-release levodopa.

Two good-quality studies (called **randomised controlled trials** ) showed that both types of levodopa can control the symptoms of Parkinson's disease. But there's a chance of problems after taking either of these drugs for five years. <sup>[22]</sup> <sup>[23]</sup>

---

## Being treated by a specialist nurse

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on being treated by a specialist nurse?](#)

This information is for people who have Parkinson's disease. It tells you about being treated by a specialist nurse. It is based on the best and most up-to-date research.

### Does it work?

Probably. There's some research that shows that being cared for by a specialist nurse can help you feel better about your general health.

Also, doctors agree that specialist nurses can make a difference to the lives of people with Parkinson's disease and their carers. They say that specialist nurse care is worth having.

### What is it?

Specialist nurses are nurses who have had extra training in looking after people with a particular condition.

Specialist nurses in Parkinson's disease have become more common in the last 10 years. <sup>[45]</sup> Doctors are keen to have nurses with specialist training in Parkinson's disease because treating the condition is complicated and patients often have many different needs.

A specialist nurse works with your doctor to make sure you get the care you need. You might see the nurse at home, at your doctor's, or in the hospital. Your nurse may also stay in touch with you over the telephone.

Here's how a specialist nurse may get involved with your care. They may: <sup>[45]</sup>

- Talk to you and your carers about Parkinson's disease and how it is likely to affect you

## Parkinson's disease

- Talk to you and your carers about the medicines available for treating Parkinson's disease and how they are used
- Check your health and symptoms. If you are taking medicines a nurse might check to see whether these are working and report back to your doctor. They will also ask you about side effects and how these are affecting you
- Organise extra care for you at home, for example if your carer is finding it difficult to cope or needs a rest
- Visit you in hospital, and liaise with hospital staff when you are discharged
- Check that you are getting the social security benefits you are entitled to
- Organise extra assessments and care when it's appropriate. For example, if your nurse thinks you would benefit from seeing a **physiotherapist** or occupational therapist, they will make sure you get an appointment.

How often you see or speak to a nurse specialist varies from one place to another. In one study, people saw a specialist nurse eight times a year. <sup>[45]</sup>

### How can it help?

There hasn't been much research on how nurse specialists can help people with Parkinson's disease. One study found that people who had care from a specialist nurse rated their overall health as better than that of people who did not have a specialist nurse assigned to them. <sup>[45]</sup> But having the care of a specialist nurse didn't reduce people's disability. And it didn't improve people's health as rated by a doctor.

However, doctors agree that nurse specialists are worthwhile for patients and their carers. It is just that there isn't very much evidence that they can help.

### How does it work?

Treating Parkinson's disease is complicated. There are many different drug treatments used to try to keep people mobile. Very often people need a number of different medicines to control their symptoms. Drug treatments may work well at first. But after a few years they often stop helping. And all treatments have side effects. This means that people with Parkinson's disease need to be monitored carefully to see whether drug treatments are working, and what side effects they are getting.

Looking after someone with Parkinson's disease is complicated, so specialist doctors have encouraged nurses to make sure patients get all the different care they might need, and to make sure they understand about the disease and the medicines they need to take. They hope that by monitoring patients more closely, people with Parkinson's will cope better with their condition, and their health and day-to-day life will be improved.

### Can it be harmful?

There's no evidence from the research that being treated by a specialist nurse can be harmful. <sup>[45]</sup> <sup>[46]</sup>

### How good is the research on being treated by a specialist nurse?

There isn't very much evidence that being cared for by a specialist nurse helps people with Parkinson's disease. We found two good-quality studies ( [randomised controlled trials](#) ) that looked at how being cared for by a specialist nurse affected people with Parkinson's disease. <sup>[47]</sup> <sup>[46]</sup>

The first study looked at nearly 2,000 people with Parkinson's. <sup>[47]</sup> Half of them saw a specialist nurse an average of eight times a year for two years, as well as seeing their GP. The people who saw a specialist nurse scored higher on a questionnaire that they filled in themselves about their general health. But there were no differences between the two groups of patients in what they were able to do and the severity of their condition as rated by a doctor.

The second study involved just 40 people. <sup>[46]</sup> People who had the care of a specialist nurse (two home visits and five phone calls over six months) did just as well as those who didn't. Both groups had similar levels of depression, anxiety, and disability. And they had similar scores on a test that measured how well they had come to terms with their illness.

Although the evidence is not very good, doctors who have worked with people who have been cared for by specialist nurses agree that it is helpful and worth having. <sup>[48]</sup>

---

## Levodopa plus amantadine

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on levodopa plus amantadine?](#)

This information is for people who have Parkinson's disease. It tells you about taking levodopa plus amantadine, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

Probably. Doctors think that taking amantadine may help reduce the movement problems that you can get when taking levodopa. But there hasn't been much research on taking the two drugs together.

## What is it?

If you start treatment with levodopa, it might work well at first. But after a while it may not work as well, or you may start to get side effects such as movements you can't control. If this happens, your doctor may suggest you take amantadine as well, to reduce these side effects.

Amantadine is an anti-viral drug that was developed to treat [flu](#) . But for many years, doctors have thought it can also help people with Parkinson's. The brand names for amantadine are Symmetrel and Lysovir.

## How can it help?

One study looked at how amantadine helped to reduce the movement problems in people taking levodopa. There were 40 people in this study. Some of them took amantadine and the rest took a dummy treatment (a [placebo](#) ). The study showed that at first taking amantadine helped, but after eight months there was no difference between people who took amantadine and people who took the dummy treatment. <sup>[49]</sup>

Another, smaller, study showed a very small improvement when the researchers used one set of measurements, but no improvement when they used another set of measurements. <sup>[50]</sup>

Although there isn't much evidence for using amantadine in this way, doctors think from experience that it can be helpful. Guidelines for doctors say it can be used in this way. <sup>[51]</sup>

## How does it work?

Amantadine may increase the amount of dopamine released from your brain cells. It can also slow down the removal of dopamine from your brain. But we don't know what effect this actually has on you. <sup>[52]</sup>

## Can it be harmful?

Amantadine does have some side effects, such as: <sup>[53]</sup>

- Seeing things that aren't there (hallucinations)
- Not being able to sleep
- Having nightmares.

You may also get swollen ankles.

Taking amantadine in the early stages of Parkinson's disease might increase your chances of having mental health problems later on.

### How good is the research on levodopa plus amantadine?

There is some evidence that taking amantadine might help reduce side effects, if you're taking levodopa. We found two good-quality studies.

The first study looked at 40 people. It showed the people who took amantadine as well as levodopa had fewer problems with unwanted movements than the people who just took levodopa. But the effects didn't last. After eight months, there was no difference between the people who took amantadine and those who didn't. <sup>[49]</sup>

The second study looked at 20 people. It showed a small improvement when the researchers used one type of scale to measure movement disorders. But there was no improvement when they used another type of scale. So the study results weren't clear. <sup>[50]</sup>

However, amantadine is often used with levodopa to help avoid side effects, and many doctors think it can be helpful.

---

## Selegiline and rasagiline

In this section

[Do they work?](#)

[What are they?](#)

[How can they help?](#)

[How do they work?](#)

[Can they be harmful?](#)

[How good is the research on selegiline and rasagiline?](#)

This information is for people who have Parkinson's disease. It tells you about selegiline and rasagiline, treatments used for Parkinson's. It is based on the best and most up-to-date research.

### Do they work?

Yes. If your Parkinson's symptoms are mild, there's a good chance that taking selegiline or rasagiline will help. But you may get side effects.

Selegiline and rasagiline can also delay when you need to start taking levodopa. This can stop you getting problems from levodopa too soon. To read more about levodopa, see [How doctors treat Parkinson's disease](#) .

### What are they?

Selegiline (brand names Eldepryl and Zelapar) and rasagiline (Azilect) belong to a group of drugs called monoamine oxidase-B inhibitors. <sup>[54]</sup> You take them as tablets.

Everyone treated for Parkinson's will need to take the drug levodopa at some time. But the benefits of levodopa usually start to wear off after about five years. It can also start causing side effects.

## Parkinson's disease

For these reasons, doctors advise people with Parkinson's to put off taking levodopa for as long as they can. Other drugs (like selegiline or rasagiline) can be used before levodopa, or together with it, to keep it working longer.

Selegiline and rasagiline are usually used in the early stages of Parkinson's disease, when symptoms are mild but are starting to get in the way of what you want to do.

### How can they help?

If you have early stage Parkinson's and you take selegiline or rasagiline: <sup>[55]</sup> <sup>[56]</sup>

- Your symptoms may get slightly better
- You may find it easier to move around and do everyday tasks.
- You might be able to delay using levodopa.

If you take selegiline with levodopa, you may not need to increase your dose of levodopa as much as you would if you didn't take selegiline.

Selegiline and rasagiline do a similar job of stopping your movements getting worse as two other drugs, bromocriptine and lisuride. <sup>[57]</sup> These are both dopamine agonists, although lisuride isn't available in the UK. For more information, see [Dopamine agonists](#)

However, a [review](#) of studies has suggested that adding selegiline or rasagiline to levodopa may not help symptoms as much as [adding a dopamine agonist](#) instead. <sup>[58]</sup> But we need more research to confirm this.

### How do they work?

Selegiline and rasagiline free up a [neurotransmitter](#) called **dopamine** in the brain. They do this by stopping a chemical called **monoamine oxidase-B** from using up dopamine. <sup>[21]</sup>

A lack of dopamine is what causes the symptoms of Parkinson's disease. (For more information, see [What is Parkinson's disease?](#) ) Selegiline and rasagiline allow more dopamine to reach the nerve cells that need it. This means symptoms such as shaking, stiff muscles, and slow movement get better.

Selegiline and rasagiline are often used on their own, but you can also take them with levodopa. Because selegiline or rasagiline helps your brain use dopamine more efficiently, you don't need to take as much levodopa. This means you're less likely to develop side effects from levodopa as soon.

### Can they be harmful?

You may get side effects if you take selegiline or rasagiline. Some people who take selegiline: <sup>[59]</sup> <sup>[60]</sup>

- Feel anxious
- Feel agitated
- Feel dizzy
- Feel sick and vomit
- Get indigestion, wind (flatulence), and diarrhoea .

These side effects will probably be mild. One study found that people who took rasagiline were just as likely to get side effects as people who took a dummy treatment (a placebo). <sup>[56]</sup>

### How good is the research on selegiline and rasagiline?

There's good evidence that selegiline and rasagiline help to relieve the symptoms of mild Parkinson's and reduce the need for levodopa. But the research also shows that people who take these drugs are more likely to get side effects.

We found one summary of the research (called a systematic review) and another good-quality study (called a randomised controlled trial). <sup>[55]</sup> <sup>[56]</sup>

The summary included 17 studies involving 3,500 people with early Parkinson's disease. <sup>[61]</sup> Most of the studies compared selegiline with a dummy tablet (a placebo) or no treatment. One study looked at rasagiline. Some people were also taking other drugs for their Parkinson's, mostly levodopa. The studies found:

- After three months, people who took selegiline had fewer symptoms, and were able to move and get on with everyday tasks better than people who took a placebo
- After 13 months, people who were also taking levodopa needed less of it to control their symptoms

The good-quality study we found compared people who took rasagiline at different doses with people who took a placebo for 10 weeks. <sup>[56]</sup> It found that people who took 2 milligrams of rasagiline a day had fewer symptoms than people who took a placebo.

### How selegiline and rasagiline compare with other drugs

We found one study that compared selegiline with three other medicines used in early Parkinson's disease: levodopa, bromocriptine, and lisuride (bromocriptine and lisuride



## Parkinson's disease

are both [dopamine agonists](#) , although lisuride isn't available in the UK ). All the drugs helped improve people's ability to move about a bit more easily, but selegiline didn't help as much as the others. <sup>[57]</sup>

Also, a summary of the research suggested that adding selegiline or rasagiline to levodopa might not work quite as well as [adding a dopamine agonist](#) . <sup>[58]</sup>

We need more research to know for certain how selegiline and rasagiline work compared with the other medicines used in early Parkinson's disease. A large study has been started in the UK to look at this.

---

## Dopamine agonists

In this section

[Do they work?](#)

[What are they?](#)

[How can they help?](#)

[How do they work?](#)

[Can they be harmful?](#)

[How good is the research on dopamine agonists?](#)

This information is for people who have Parkinson's disease. It tells you about dopamine agonists, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Do they work?

Yes. If you take a dopamine agonist in the early stages of Parkinson's disease, it may help your symptoms. It doesn't help as much as [levodopa](#) .

It can also delay when you need to start taking levodopa. Levodopa is the standard treatment for Parkinson's. But it can have serious side effects.

Dopamine agonists are also less likely than levodopa to cause movements you can't control. But you may get some other serious side effects with dopamine agonists.

### What are they?

Dopamine agonists are drugs that affect the brain in the same way as the chemical dopamine . <sup>[62]</sup> People with Parkinson's don't have enough dopamine, so these drugs can help them by replacing some of the dopamine they are missing.

Dopamine agonists are often used so people can delay starting to take levodopa. Levodopa is the best treatment for Parkinson's, but it stops working as well over time, and its effects start to wear off. Levodopa can also cause bad side effects.

You can take dopamine agonists in two ways.

- On their own: you may be given a dopamine agonist in the early stages of Parkinson's to delay starting levodopa. When your symptoms get worse, your doctor might then

## Parkinson's disease

give you levodopa to take when your symptoms are bad. This is sometimes called rescue medication or rescue levodopa.

- With levodopa: you may also take a dopamine agonist along with levodopa. This combination may help you to take less levodopa, so it keeps working for longer. (To read more, see [Adding a dopamine agonist to levodopa](#) .)

Here are some examples of dopamine agonists (with their brand names):

- apomorphine (APO-go) (for people with advanced Parkinson's)
- bromocriptine (Parlodel)
- cabergoline (Dostinex)
- pergolide (Celance)
- pramipexole (Mirapexin)
- ropinirole (Requip)
- rotigotine (Neupro).

You can take most of these drugs as tablets. Apomorphine comes as injections. Rotigotine comes as a skin patch.

If one dopamine agonist doesn't seem to help you, your doctor may try giving you a different one to see if that one works instead.

The dopamine agonists bromocriptine, cabergoline, and pergolide can cause damage to your heart and lungs. You'll need tests before starting treatment to make sure your heart is healthy, and check ups during treatment to make sure you don't develop problems. If you need to take these drugs they'll usually be prescribed by a specialist.

The National Institute for Health and Care Excellence (NICE), the government body that decides which treatments should be available on the NHS, has said that people should be treated with other types of dopamine agonists that don't need these extra tests. <sup>[63]</sup> Drugs that don't need extra tests include pramipexole (Mirapexin), ropinirole (Requip), and rotigotine (Neupro).

### How can they help?

If you take a dopamine agonist instead of levodopa early on, your symptoms may improve. And you may not get the side effects that people get if they take levodopa for a long time.

<sup>[64]</sup> <sup>[28]</sup> Side effects are the biggest problem with levodopa. Half of the people who take

## Parkinson's disease

it get problems. For example, they may get movements they can't control, or the medicine may start working for a shorter time. <sup>[40]</sup>

But your symptoms may not improve as much as they would if you took [levodopa on its own](#). <sup>[64] [28] [65]</sup>

To read more, see [How doctors treat Parkinson's disease](#).

### How do they work?

Dopamine agonists affect the brain in the same way as dopamine. <sup>[21]</sup>

People with Parkinson's disease have less dopamine in their brain than people who don't have the disease. <sup>[1]</sup> This is because the cells that make dopamine have died or don't work as well. Too little dopamine leads to the symptoms of Parkinson's disease. (To learn more, see [What is Parkinson's disease?](#) )

By working in the same way as dopamine in the brain, dopamine agonists relieve symptoms such as shaking, stiff muscles, and slow movement. With fewer symptoms, you may be able to delay when you start taking levodopa or use less levodopa. This means you'll be less likely to develop side effects as soon. <sup>[62]</sup>

Also, if you take a dopamine agonist with levodopa, your symptoms may not be as bad when your dose of levodopa starts to wear off. This is because a dose of a dopamine agonist may relieve symptoms for longer than a dose of levodopa does. <sup>[62]</sup>

### Can they be harmful?

Yes. Some people get serious side effects when they take a dopamine agonist.

Side effects generally go away if you take less of the drug, but some people have to stop taking this treatment completely.

You may get these side effects when you take a dopamine agonist: <sup>[26] [25]</sup>

- Nausea
- Vomiting
- Dizziness
- Sleepiness
- Being unable to sleep (insomnia)
- Indigestion
- Confusion

## Parkinson's disease

- Constipation
- Seeing things that aren't there (hallucinations).

If you take rotigotine as a skin patch, you might get a reaction at the spot where you wear it. You might get a rash, swelling, or itching. <sup>[66]</sup>

Up to a third of people who take dopamine agonists feel very sleepy. You shouldn't drive if you find yourself dozing off in unusual situations. <sup>[67]</sup>

### Heart and lung problems

The dopamine agonists bromocriptine, cabergoline, and pergolide can cause damage to your heart and lungs. <sup>[68]</sup> They do this by causing inflammation, thickening, and scarring in the tissue inside your chest. This problem is called **fibrosis**.

If you have fibrosis, you may:

- Feel breathless
- Get a cough that doesn't get better
- Get pain in your chest
- Feel tender in your lower abdomen.

Contact your doctor straight away if you get any of these symptoms, whatever dopamine agonist you are taking.

If you're prescribed bromocriptine, cabergoline, and pergolide, it will probably be by a specialist, and only if other drugs haven't worked. Your doctor should run tests to check for fibrosis of the heart before prescribing one of these drugs. You'll need an ultrasound scan of your heart (an echocardiogram), and possibly blood tests and chest x-rays. You'll need regular check ups as you carry on with treatment.

### Compulsive behaviour

A report from Europe says taking dopamine agonists may be linked to certain compulsive disorders. <sup>[69]</sup> A compulsive disorder is when you have an urge to do something and it's difficult to control. Compulsive disorders often cause problems in people's lives.

Dopamine agonists have been linked to:

- Compulsive gambling
- Compulsive sexual behaviour.

### How good is the research on dopamine agonists?

We found good evidence that dopamine agonists work in the early stages of Parkinson's disease. But these drugs can cause bad side effects. Also, more research is needed to find out which dopamine agonists work best.

We found one summary of the research (called a [systematic review](#) ) and one more good-quality study (called a [randomised controlled trial](#) ). <sup>[64]</sup> <sup>[28]</sup>

These show that in early Parkinson's:

- Dopamine agonists cause fewer problems with movement (such as twitching or writhing) than [levodopa](#)
- But levodopa is better than dopamine agonists at controlling the symptoms of Parkinson's.

The summary of the research looked at 29 studies, including 5,247 people. It found that people taking levodopa got problems with their movements earlier than those taking a dopamine agonist. <sup>[64]</sup>

A study of 294 people found that pergolide caused fewer movement problems than levodopa did after three years. <sup>[28]</sup> But more people taking pergolide withdrew from treatment.

Two studies found that a rotigotine skin patch could help with the early symptoms of Parkinson's. <sup>[70]</sup> <sup>[71]</sup> Side effects were similar to people who took dopamine agonists as tablets. Some people also got a rash or skin irritation around the patch.

---

### Adding levodopa to a dopamine agonist

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on adding levodopa to a dopamine agonist?](#)

This information is for people who have Parkinson's disease. It tells you about adding levodopa to your treatment if you're already taking a dopamine agonist. It is based on the best and most up-to-date research.

#### Does it work?

Yes. If you're taking a dopamine agonist, adding in levodopa may stop your symptoms from coming back between doses. And you may get fewer side effects than you would get from taking levodopa alone.

# Parkinson's disease

## What is it?

When you first need treatment for Parkinson's, you might start with [levodopa](#) or a [dopamine agonist](#). (See [How doctors treat Parkinson's disease](#).) Both these treatments increase the amount of dopamine in your brain. But if your symptoms start to get worse with one of these treatments, your doctor may suggest that you take both of them together.

Here we look at what will happen if you start off taking a dopamine agonist and then add in levodopa. Some people may start off taking levodopa and then add in a dopamine agonist if their symptoms get worse. To learn more, see [Adding a dopamine agonist to levodopa](#).

Here are some examples of dopamine agonists. We've listed each drug's name (and brand name).

- apomorphine (APO-go) (for advanced Parkinson's disease)
- bromocriptine (Parlodel)
- cabergoline (Dostinex)
- pergolide (Celance)
- pramipexole (Mirapexin)
- ropinirole (Requip).

You can take most of these drugs as tablets. Apomorphine comes as injections. Rotigotine comes as a skin patch.

If one dopamine agonist doesn't seem to help you, your doctor may try a different one to see if it works better.

The dopamine agonists bromocriptine, cabergoline, and pergolide can cause damage to your heart and lungs. You'll need tests before starting treatment to make sure your heart is healthy, and check ups during treatment to make sure you don't develop problems. If you need to take these drugs they'll usually be prescribed by a specialist.

The National Institute for Health and Care Excellence (NICE), the government body that decides which treatments should be available on the NHS, has said that people should be treated with other types of dopamine agonists that don't need these extra tests.<sup>[63]</sup> Drugs that don't need extra tests include pramipexole (Mirapexin), ropinirole (Requip), and rotigotine (Neupro).

## Adding in levodopa

If you still get some symptoms when you take a dopamine agonist, or your symptoms come back after some time, your doctor may recommend that you also take levodopa.

## Parkinson's disease

They may tell you take levodopa only when your symptoms are bad. When you take levodopa this way, it's called rescue levodopa. This way, you use less levodopa than if you took a pill every four hours, for example.

There are a few ways to take levodopa.

- Most likely, you'll be given levodopa with another drug called carbidopa or benserazide. <sup>[21]</sup> The brand name of the combination of levodopa and carbidopa is called co-careldopa (brand name Sinemet). The combination of levodopa and benserazide is called co-beneldopa (brand name Madopar). Carbidopa and benserazide prevent levodopa being changed into dopamine before it reaches your brain. This reduces the side effects of levodopa. It also reduces the amount of levodopa you need.
- You can also take co-careldopa and co-beneldopa as extended-release and controlled-release tablets or capsules. If you take this type of levodopa, you may not need to take tablets so often. That's because the levodopa is released gradually into your body over a few hours.
- Madopar also comes in tablets that can be dissolved in water or orange squash (but not orange juice). You can use these to give you a kick start in the morning, because the drug gets absorbed quicker than when you take the usual tablets. It's also useful if you're having problems swallowing tablets or capsules.

### How can it help?

If you've been taking a dopamine agonist, but your symptoms have been getting worse, then taking levodopa as well may: <sup>[72] [73] [29] [27]</sup>

- Stop your symptoms coming back between doses
- Reduce some of the unwanted movements that you would get from taking levodopa alone.

### How does it work?

People with Parkinson's disease have less dopamine in their brain than people who don't have the disease. This is because the brain cells that should make dopamine have died or don't work as well. A lack of dopamine leads to Parkinson's symptoms, such as moving slowly and clumsily.

You can't take dopamine tablets, because dopamine is not able to pass from your bloodstream into your brain. But if you take levodopa, this gets into your brain and is changed into dopamine by your brain cells. The extra dopamine then reduces the symptoms of Parkinson's, such as shaking, stiff muscles, and slow movement.

Dopamine agonists affect the brain in the same way as dopamine. <sup>[74]</sup>

## Parkinson's disease

If you've had Parkinson's disease for some time and have been taking a dopamine agonist, you may have noticed that your symptoms come back sooner than they used to. To stop this from happening, your doctor may prescribe levodopa to take when your symptoms come back. This should help to stop your symptoms coming back between doses.

### Can it be harmful?

Yes. You can get serious side effects from both levodopa and dopamine agonists.

### Side effects of dopamine agonists

Some people get serious side effects when they take a dopamine agonist. These problems usually go away if they take a smaller dose, but some people have to stop taking this treatment altogether.

Usually, older people do not take dopamine agonists because they are more likely to get side effects than younger people.

You may get the following side effects when you take a dopamine agonist: <sup>[75]</sup>

- Nausea
- Vomiting
- Sleepiness
- Being unable to sleep (insomnia)
- Indigestion
- Constipation
- Dizziness
- Confusion
- Imagining things that aren't real ( hallucinations ).

If you take rotigotine as a skin patch, you might get a reaction at the spot where you wear it. You might get a rash, swelling, or itching. <sup>[66]</sup>

Up to a third of people who take dopamine agonists feel very sleepy. You shouldn't drive if you find yourself dozing off in unusual situations. <sup>[67]</sup>



# Parkinson's disease

## Heart and lung problems

The dopamine agonists bromocriptine, cabergoline, and pergolide can cause damage to your heart and lungs.<sup>[75]</sup> They do this by causing inflammation, thickening, and scarring in the tissue inside your chest. This problem is called **fibrosis**.

If you have fibrosis, you may:

- Feel breathless
- Get a cough that doesn't get better
- Get pain in your chest
- Feel tender in your lower abdomen.

Contact your doctor straight away if you get any of these symptoms, whatever dopamine agonist you are taking.

If you're prescribed bromocriptine, cabergoline, and pergolide, it will probably be by a specialist, and only if other drugs haven't worked. Your doctor should run tests to check for fibrosis of the heart before prescribing one of these drugs. You'll need an ultrasound scan of your heart (an echocardiogram), and possibly blood tests and chest x-rays. You'll need regular check ups as you carry on with treatment.

## Compulsive behaviour

A report from Europe says taking dopamine agonists may be linked to certain compulsive disorders.<sup>[69]</sup> A compulsive disorder is when you have an urge to do something and it's difficult to control. Compulsive disorders often cause problems in people's lives.

Dopamine agonists have been linked to:

- Compulsive gambling
- Compulsive sexual behaviour.

## Side effects of levodopa

Levodopa can cause several serious side effects. These usually start a few years after taking levodopa. The most common problems are:<sup>[44]</sup>

- Wearing off. This happens when your levodopa dose becomes less effective, so it wears off more quickly. For example, you may notice your symptoms are worse than they used to be before your first dose in the morning. Your muscles might also start to stiffen or your hands might start to tremble before your next dose is due

## Parkinson's disease

- On-off effect. Your symptoms may come back and go away suddenly. When your symptoms come back, this is called 'off time'. Off times may last a few minutes or hours. When your symptoms go away, this is called 'on time'. People who look after someone with Parkinson's say the effect is like a light being switched on and off. One minute the person is joining in with conversation and other people, and the next minute they freeze and go quiet. Off times can happen several times a day. They are not related to when you take your medicine
- Movements you can't control. These can happen just before or after you take your dose of levodopa, or midway between two doses. You may nod your head over and over again. Or you may jerk your leg, smack your lips, or make a strange face. You may also move your body into strange positions. Doctors call these movements dyskinesias (abnormal jerking movements) and dystonia (a type of movement problem that causes abnormal twisting and body positions).

But if you take start taking a dopamine agonist and then add in rescue levodopa when your symptoms back you're less likely to get these side effects than if you had taken levodopa from the start. <sup>[72]</sup> <sup>[73]</sup> <sup>[29]</sup> <sup>[27]</sup>

Other problems you might get while taking levodopa are: <sup>[23]</sup>

- Nausea and vomiting
- Dizziness
- Sleep problems
- Stomach pain
- Headache
- Feeling agitated
- Depression.

### Taking the two drugs together

Taking the dopamine agonist pramipexole and adding in levodopa can make sleepiness and hallucinations worse. <sup>[73]</sup>

### How good is the research on adding levodopa to a dopamine agonist?

There's some good evidence that taking a dopamine agonist plus levodopa can reduce the side effects you would get from taking levodopa alone, and stop your symptoms coming back between doses. Four good-quality studies showed that taking a dopamine agonist plus levodopa reduced side effects. <sup>[72]</sup> <sup>[73]</sup> <sup>[29]</sup> <sup>[27]</sup>

## Parkinson's disease

But other studies have found that adding levodopa to treatment with a dopamine agonist for people with Parkinson's disease does not reduce the unwanted movements you get from taking levodopa. <sup>[24]</sup> <sup>[30]</sup>

Some studies have found that taking levodopa on its own is better for the symptoms of Parkinson's disease than taking a dopamine agonist and adding levodopa. <sup>[72]</sup> <sup>[73]</sup> <sup>[29]</sup> <sup>[27]</sup> They found that levodopa alone improved people's ability to move and do things for themselves more than the two treatments combined did.

---

## Adding a dopamine agonist to levodopa

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on adding a dopamine agonist to levodopa?](#)

This information is for people who have Parkinson's disease. It tells you about adding a dopamine agonist to your treatment if you're already taking levodopa. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you're taking levodopa and it's not working as well as it used to, then taking a dopamine agonist may help your symptoms. But you may get more side effects when you take the two drugs together.

### What is it?

When you first need treatment for Parkinson's you might start with levodopa or a dopamine agonist. (See [How doctors treat Parkinson's disease](#) .) Both these treatments increase the amount of dopamine in your brain. But if your symptoms start to get worse with one of these treatments, your doctor may suggest that you take both of them together. This may help your symptoms. It may also allow you to take less levodopa so that you get fewer side effects. <sup>[76]</sup>

Here are some examples of the dopamine agonists. We've listed each drug's name (and brand name).

- bromocriptine (Parlodel)
- cabergoline (Dostinex)
- pergolide (Celance)
- pramipexole (Mirapexin)

## Parkinson's disease

- ropinirole (Requip)
- apomorphine (APO-go). This is used in people with advanced Parkinson's.

You can take most of these drugs as tablets. Apomorphine comes as injections. Rotigotine comes as a skin patch.

If one dopamine agonist doesn't seem to help you, your doctor may try giving you a different one to see if this works.

The dopamine agonists bromocriptine, cabergoline, and pergolide can cause damage to your heart and lungs. You'll need tests before starting treatment to make sure your heart is healthy, and check ups during treatment to make sure you don't develop problems. If you need to take these drugs they'll usually be prescribed by a specialist.

The National Institute for Health and Care Excellence (NICE), the government body that decides which treatments should be available on the NHS, has said that people should be treated with other types of dopamine agonists that don't need these extra tests.<sup>[63]</sup> Drugs that don't need extra tests include pramipexole (Mirapexin), ropinirole (Requip), and rotigotine (Neupro).

### How can it help?

If you've been taking a dopamine agonist or levodopa but your symptoms have been getting worse, taking the two treatments together may:

- Improve your symptoms<sup>[77] [78]</sup>
- Reduce your side effects from levodopa, especially movements that you can't control<sup>[77] [25] [27] [29]</sup>
- Reduce your 'off time' (this is when your symptoms come back)<sup>[77] [79]</sup>
- Reduce the amount of levodopa you need to take<sup>[77] [80] [81]</sup>
- Make you more able to carry out your everyday activities.<sup>[21]</sup>

We don't know which dopamine agonist works best.

Adding a dopamine agonist to levodopa may work better than adding drugs called [COMT inhibitors](#) or [monoamine oxidase-B inhibitors](#) to levodopa instead.<sup>[58]</sup> However, we need more good studies to confirm this.

### How does it work?

Dopamine agonists affect the brain in the same way as [dopamine](#).<sup>[21]</sup>

## Parkinson's disease

People with Parkinson's disease have less dopamine in their brain than people who don't have the disease.<sup>[1]</sup> This is because the cells that should produce dopamine have died or don't work as well. Too little dopamine leads to the symptoms of Parkinson's disease. (To learn more, see [What is Parkinson's disease?](#) )

By working in the brain in the same way as dopamine, dopamine agonists relieve symptoms such as shaking, stiff muscles, and slow movement.

If you've had Parkinson's disease for some time and have been taking levodopa, you may have noticed that your symptoms come back sooner than they used to. To stop this from happening, your doctor may prescribe a dopamine agonist. This helps levodopa work for longer, so your symptoms don't come back as soon.<sup>[76]</sup>

### Can it be harmful?

Yes. You can get serious side effects from both levodopa and dopamine agonists.

### Side effects of dopamine agonists

Some people get serious side effects when they take a dopamine agonist. These problems usually go away if they take a smaller dose, but some people have to stop taking this treatment altogether.

Usually, older people do not take dopamine agonists because they are more likely to get side effects than younger people.

You may get the following side effects when you take a dopamine agonist:<sup>[75]</sup>

- Nausea
- Vomiting
- Sleepiness
- Being unable to sleep (insomnia)
- Indigestion
- Constipation
- Dizziness
- Confusion
- Imagining things that aren't real ( hallucinations ).

## Parkinson's disease

If you take rotigotine as a skin patch, you might get a reaction at the spot where you wear it. You might get a rash, swelling, or itching. <sup>[66]</sup>

Up to a third of people who take dopamine agonists feel very sleepy. You shouldn't drive if you find yourself dozing off in unusual situations. <sup>[67]</sup>

### Heart and lung problems

The dopamine agonists bromocriptine, cabergoline, and pergolide can cause damage to your heart and lungs. <sup>[68]</sup> They do this by causing inflammation, thickening, and scarring in the tissue inside your chest. This problem is called **fibrosis**.

If you have fibrosis, you may:

- Feel breathless
- Get a cough that doesn't get better
- Get pain in your chest
- Feel tender in your lower abdomen.

Contact your doctor straight away if you get any of these symptoms, whatever dopamine agonist you are taking.

If you're prescribed bromocriptine, cabergoline, and pergolide, it will probably be by a specialist, and only if other drugs haven't worked. Your doctor should run tests to check for fibrosis of the heart before prescribing one of these drugs. You'll need an ultrasound scan of your heart (an echocardiogram), and possibly blood tests and chest x-rays. You'll need regular check ups as you carry on with treatment.

### Compulsive behaviour

A report from Europe says taking dopamine agonists may be linked to certain compulsive disorders. <sup>[69]</sup> A compulsive disorder is when you have an urge to do something and it's difficult to control. Compulsive disorders often cause problems in people's lives.

Dopamine agonists have been linked to:

- Compulsive gambling
- Compulsive sexual behaviour.

### Side effects of levodopa

Levodopa can cause several serious side effects. These usually start a few years after taking levodopa. The most common problems are: <sup>[44]</sup>

## Parkinson's disease

- Wearing off. This happens when your levodopa dose becomes less effective, so it wears off more quickly. For example, you may notice your symptoms are worse than they used to be before your first dose in the morning. Your muscles might also start to stiffen or your hands might start to tremble before your next dose is due
- On-off effect. Your symptoms may come back and go away suddenly. When your symptoms come back, this is called 'off time'. Off times may last a few minutes or hours. When your symptoms go away, this is called 'on time'. People who look after someone with Parkinson's say the effect is like a light being switched on and off. One minute the person is joining in with conversation and other people, and the next minute they freeze and go quiet. Off times can happen several times a day. They are not related to when you take your medicine
- Movements you can't control. These can happen just before or after you take your dose of levodopa, or midway between two doses. You may nod your head over and over again. Or you may jerk your leg, smack your lips, or make a strange face. You may also move your body into strange positions. Doctors call these movements dyskinesias (abnormal jerking movements) and dystonia (a type of movement problem that causes abnormal twisting and body positions).

But if you start taking a dopamine agonist and then add in rescue levodopa when your symptoms come back, you're less likely to get these side effects than if you had taken levodopa from the start. <sup>[27]</sup> <sup>[29]</sup> <sup>[72]</sup> <sup>[73]</sup>

Other problems you might get while taking levodopa are: <sup>[23]</sup>

- Nausea and vomiting
- Dizziness
- Sleep problems
- Stomach pain
- Headache
- Feeling agitated
- Depression.

### Taking the two drugs together

Taking levodopa and adding in a dopamine agonist can make the side effects caused by levodopa worse. In particular, you may find the unwanted movements caused by levodopa get worse. <sup>[77]</sup> <sup>[80]</sup> <sup>[81]</sup>

### How good is the research on adding a dopamine agonist to levodopa?

We found good evidence that taking a dopamine agonist with levodopa can reduce your symptoms. But these drugs can cause side effects. Also, we need more research to know which dopamine agonist works best.

We found one summary of the research (called a [systematic review](#) ) and five more good-quality studies (called [randomised controlled trials](#) ) comparing dopamine agonist treatment plus levodopa with levodopa on its own in the early stages of Parkinson's. <sup>[25]</sup>  
<sup>[26]</sup> <sup>[27]</sup> <sup>[29]</sup> <sup>[30]</sup> <sup>[82]</sup>

The summary of the research found that there wasn't any good evidence that taking bromocriptine with levodopa could reduce symptoms. <sup>[82]</sup>

However, other studies found that taking dopamine agonist treatment plus levodopa can: <sup>[25]</sup>  
<sup>[26]</sup> <sup>[27]</sup> <sup>[29]</sup> <sup>[30]</sup>

- Reduce your symptoms
- Help you do everyday activities
- Reduce how much levodopa you need to take
- Reduce the side effects you get from levodopa.

We also found six summaries and one good-quality study that looked at adding a dopamine agonist to levodopa in the later stages of Parkinson's. <sup>[83]</sup> <sup>[84]</sup> <sup>[77]</sup> <sup>[80]</sup> <sup>[79]</sup> <sup>[81]</sup>  
<sup>[41]</sup>

Both the summaries and the study found that certain dopamine agonists can:

- Help reduce the symptoms of Parkinson's disease
- Stop levodopa wearing off between doses
- Reduce on-off effects (when your symptoms suddenly come back and then go away).

But some people get more side effects from taking the two types of drugs together than from taking levodopa on its own.

Adding a dopamine agonist to levodopa may work better than adding drugs called [COMT inhibitors](#) or [monoamine oxidase-B inhibitors](#) to levodopa instead. <sup>[58]</sup> However, we need more good studies to confirm this.



## Which dopamine agonist is best?

There's been quite a lot of research comparing some of the dopamine agonists. But it isn't good enough to say whether one drug works better than another. <sup>[41]</sup> <sup>[85]</sup> <sup>[86]</sup> <sup>[87]</sup>

<sup>[88]</sup> <sup>[89]</sup> Also, we need research comparing the newer dopamine agonists, such as pramipexole and ropinirole.

---

## Levodopa plus entacapone or tolcapone

In this section

[Does it work?](#)

[What are they?](#)

[How can they help?](#)

[How do they work?](#)

[Can they be harmful?](#)

[How good is the research on levodopa plus entacapone or tolcapone?](#)

This information is for people who have Parkinson's disease. It tells you about taking levodopa with entacapone or tolcapone, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you're taking levodopa and it's not working as well as it used to, then taking entacapone or tolcapone as well may help your symptoms. But you may get side effects.

### What are they?

Entacapone (brand name Comtess) and tolcapone (brand name Tasmar) belong to a group of drugs called COMT inhibitors. They stop levodopa being broken down by your body as quickly as usual. This means your dose of levodopa can work for a longer time.

There is a combination drug to treat Parkinson's that contains levodopa, carbidopa, and entacapone. The brand name is Stalevo.

### How can they help?

If you take entacapone or tolcapone with levodopa, the levodopa levels in your brain should remain steady for a longer time. This means you have less time when your symptoms come back ('off time'). Entacapone reduces off time by at least an hour. <sup>[90]</sup>

<sup>[91]</sup> It also lets you reduce your dose of levodopa. <sup>[92]</sup>

A [review](#) of studies has suggested that adding entacapone or tolcapone to levodopa may not help symptoms as much as [adding a dopamine agonist](#) instead. <sup>[58]</sup> However, we need more research to confirm this.

### How do they work?

COMT inhibitors stop a chemical called catechol-O-methyl transferase (COMT) working. COMT breaks down levodopa so there's more levodopa in your brain. By taking a COMT

## Parkinson's disease

inhibitor, such as entacapone or tolcapone, your levodopa will work for longer and reduce your symptoms.

### Can they be harmful?

Yes. Entacapone can cause jerking movements (**dyskinesias**), nausea, vomiting, diarrhoea, constipation, and dizziness.<sup>[92]</sup> It can also make your urine go orange.<sup>[93]</sup>

In the UK, tolcapone was withdrawn from the market in 1998 because it can cause serious liver problems.<sup>[93]</sup> It's now available again, but it can only be prescribed by a specialist.

You will need to have a test to check your liver is healthy before you start taking tolcapone and throughout your treatment. You need to have a liver test every two weeks for the first year of treatment, then every four weeks for the next six months, and every eight weeks after that.<sup>[94]</sup>

You should see your doctor if you have any of the following symptoms:

- Pale stools
- Yellow skin
- Yellow eye whites
- Extreme tiredness
- Loss of appetite
- Lack of energy.

In one trial, men taking levodopa, carbidopa, and entacapone were more likely to develop prostate cancer.<sup>[95]</sup> Treatment lasted between two-and-a-half years and four years. During this time, 3.7 percent of men taking levodopa, carbidopa, and entacapone developed prostate cancer. This compared with 0.9 percent of men taking carbidopa and levodopa.

Other studies haven't found a risk of prostate cancer with levodopa, carbidopa, and entacapone.<sup>[95]</sup>

### How good is the research on levodopa plus entacapone or tolcapone?

There's some good evidence that taking entacapone or tolcapone along with levodopa can help control the symptoms of Parkinson's disease.

We found one summary of the research (called a **systematic review**) and two newer good-quality studies (called **randomised controlled trials**).<sup>[96]</sup> <sup>[97]</sup> <sup>[98]</sup>

## Parkinson's disease

The summary included 14 studies that looked at more than 2,500 people.<sup>[96]</sup> The people in the studies took either levodopa plus entacapone or tolcapone, or levodopa plus a dummy tablet (a [placebo](#)). The studies found that the people who took entacapone or tolcapone:

- Had less 'off time' (this is when symptoms come back while taking a Parkinson's drug)
- Took lower doses of levodopa.

People who took entacapone also had less difficulty moving around and doing daily tasks. But in most of the studies the people who took tolcapone didn't find it easier to move around or do daily tasks.

The two newer studies found that entacapone reduced 'off time' by more than an hour.<sup>[97]</sup> <sup>[98]</sup>

However, another summary of the research suggested that adding a COMT inhibitor to levodopa might not work quite as well as [adding a dopamine agonist](#).<sup>[58]</sup> But we need good-quality studies to confirm this.

---

## Pallidotomy

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on pallidotomy?](#)

This information is for people who have Parkinson's disease. It tells you about pallidotomy, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

Yes, it works for some people. But there is a high risk of serious problems with this kind of surgery. So, your doctor will probably suggest this operation only if you're in the later stages of Parkinson's disease when drugs no longer work.

### What is it?

Pallidal surgery is done on a part of your brain known as the **globus pallidus**. There are two types of pallidal surgery: **pallidotomy** and **pallidal deep brain stimulation**.

Today, you are most likely to have pallidal deep brain stimulation. It's a newer operation and doctors consider it safer. To learn more, see [Pallidal deep brain stimulation](#). Here we are looking at pallidotomy.

## Parkinson's disease

Pallidal surgery is just one type of surgery for Parkinson's disease. To learn about others, see [Other types of brain surgery](#) .

Pallidotomy destroys the brain cells in the globus pallidus. The aim is to reduce your symptoms of Parkinson's and the uncontrolled movements that can happen if you've been taking the drug levodopa for a long time.

Each side of the brain has a globus pallidus. You can have surgery on one side (unilateral surgery) or both sides (bilateral surgery).

Before the operation, your surgeon will use something called stereotactic technology to pinpoint the part of your brain that needs treatment. <sup>[99]</sup> Here's how it works.

- A frame is fixed to your head with four pins to keep it still. You'll be given a **local anaesthetic** so you'll be awake but it won't hurt.
- Your surgeon will then create a detailed picture (map) of your brain using one of two types of scans: **magnetic resonance imaging (MRI)** or **computed tomography (CT)** .
- They will then use computer software to find a path through your brain to the exact spot that needs to be treated.

After your surgeon has found the part of your brain that needs treatment, they will:

- Make a cut about 5 centimetres (2 inches) long in your skull
- Put a small **electrode** through the hole into your brain and along the path they've mapped out.

When the tip of the electrode reaches its target, your surgeon will take electrical readings to pinpoint the target exactly. They will then destroy the brain cells in that area. To do this, they will heat up the electrode to about 85 degrees Celsius (185 degrees Fahrenheit) to burn the brain cells away. <sup>[100]</sup> Then they remove the electrode from your brain.

The operation can take up to eight hours, and you'll need to stay in hospital for about a week. You should be able to see the effects of the operation as soon as you wake up.

This surgery cannot be reversed (the brain cells are destroyed).

Brain surgery is difficult and things can go wrong. Before you decide to have surgery, you should talk to your surgeon about problems that can happen and how likely you are to get these problems. <sup>[101]</sup>

### How can it help?

Pallidotomy can: <sup>[102]</sup> <sup>[103]</sup>

## Parkinson's disease

- Reduce the symptoms of Parkinson's, such as shaking, slow movement, and problems keeping your balance. In one study, symptom scores improved by an average of 30 percent in people who had surgery.<sup>[104]</sup> In people who had medication, symptoms scores got worse by an average of 5 percent
- Reduce the movement problems that you can get from Parkinson's medication
- Reduce the 'off time' that can happen if you've been taking levodopa for several years. Off time is when your symptoms come back. This may happen because your levodopa dose is wearing off too quickly, or because you're getting on-off effects (this is when your symptoms suddenly come back and go away).

Research also shows that:

- Pallidotomy on one side of the brain (unilateral pallidotomy) can reduce 'off time' by about a third and uncontrolled movements by half<sup>[105]</sup>
- Pallidotomy doesn't improve poor balance as much as it improves other symptoms of Parkinson's<sup>[106]</sup>
- The benefits of pallidotomy usually last several years<sup>[102]</sup>
- Pallidotomy may work as well as pallidal deep brain stimulation. But you're more likely to get side effects with pallidotomy.<sup>[107]</sup> However, the study we found was small and more research is needed to find out how these operations compare
- Pallidotomy may not work as well as deep brain stimulation to another part of the brain called the subthalamic nucleus.<sup>[108]</sup>

### How does it work?

The globus pallidus is overactive in the brains of people with Parkinson's disease.<sup>[109]</sup> Destroying it should reduce its activity. Then pathways for carrying messages in the brain can work better and your symptoms should improve.

But doctors aren't exactly sure why pallidal surgery helps reduce the uncontrolled movements that can happen if you take levodopa for a long time.<sup>[109]</sup>

### Can it be harmful?

Yes. Many problems can happen after you have a pallidotomy.

- Up to 1 in 10 people get serious problems after this operation (some even die).<sup>[110]</sup> In one study, which looked at 18 people who had surgery, two people had seizures

## Parkinson's disease

(fits) and one had bleeding in the brain ( haemorrhage ).<sup>[104]</sup> One person had to take medicines to control their seizures. The other two had no lasting problems.

- Nearly 1 in 3 people who have a pallidotomy on one side of their brain get side effects that last for six months after surgery.<sup>[105]</sup> The most common problems are losing control of your urine (incontinence), problems swallowing, and problems with speech.
- Surgery on both sides of the brain can be particularly risky. One study was stopped because of side effects.<sup>[107]</sup> The first three people who had surgery became depressed and their speech, swallowing, walking, and balance got much worse.
- Some people find it hard to say or think of the right words after a pallidotomy.<sup>[111]</sup>
- Pallidotomy on the left side of the brain, and possibly on the right, can make your speech worse.<sup>[112]</sup>

However, the chances of having problems after this surgery are falling as surgeons get better at doing this operation.<sup>[101]</sup>

There's some evidence that you're more likely to get side effects after a pallidotomy than after deep brain stimulation.<sup>[107]</sup>

### How good is the research on pallidotomy?

We found some evidence that pallidotomy can help people with Parkinson's. But there's also a lot of evidence that it can cause problems.

We found two summaries of the research (called systematic reviews ) that included two studies comparing surgery with drug treatment.<sup>[102]</sup> <sup>[113]</sup> The studies mostly looked at people with advanced Parkinson's disease who had pallidotomy on one side of the brain

- The first study (36 people) found that surgery improved people's symptoms, including shaking, slow movement, stiff muscles, and poor balance. It also decreased people's 'off time' (this is when a person's symptoms come back while taking a Parkinson's drug) and reduced side effects from drug treatment.<sup>[104]</sup> In this study, the symptom scores of people who had surgery improved by an average of 30 percent while those of people who took medication got worse by an average of 5 percent.<sup>[104]</sup>
- The second study (37 people) found that surgery reduced 'off time' by about 30 percent.<sup>[105]</sup> People also had 50 percent less twitching (twitching can develop when people take Parkinson's drugs for a long time).

## Parkinson's disease

- The improvements in 'off time' and twitching were still there one year and two years after surgery. <sup>[104]</sup> <sup>[105]</sup>

We also found a study that compared pallidotomy on one side of the brain (unilateral surgery) with [subthalamic deep brain stimulation](#) on both sides of the brain (bilateral surgery). <sup>[108]</sup> This study looked at 34 people. It showed that, after six months, the symptoms of people who had subthalamic deep brain stimulation were three times better than the symptoms of people who'd had a pallidotomy. Those who'd had subthalamic deep brain stimulation also moved better during on phases and had fewer abnormal movements.

---

## Pallidal deep brain stimulation

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on pallidal deep brain stimulation?](#)

This information is for people who have Parkinson's disease. It tells you about pallidal deep brain stimulation, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

It may do, but we don't know for certain. We need more research to know how well pallidal deep brain stimulation works and how safe it is. Your doctor will probably suggest this operation only if you're in the later stages of Parkinson's disease when drugs no longer work. Pallidal deep brain stimulation is not often done in the UK.

### What is it?

Pallidal surgery is done on a part of your brain known as the **globus pallidus**. There are two types of pallidal surgery: **pallidotomy** and **pallidal deep brain stimulation**. Today, you are most likely to have pallidal deep brain stimulation. It's a newer operation and doctors consider it safer.

Pallidal surgery is just one type of surgery for Parkinson's disease. To learn about others, see [Other types of brain surgery](#) .

Pallidal deep brain stimulation temporarily stuns the cells in the globus pallidus. It doesn't destroy the cells like pallidotomy. And it allows you to control the amount of electrical current used to stun the cells. The aim is to reduce your symptoms of Parkinson's and the uncontrolled movements that can happen if you've been taking the drug levodopa for a long time.

Each side of the brain has a globus pallidus. You can have surgery on one side (unilateral surgery) or on both sides (bilateral surgery).

## Parkinson's disease

Before the operation, your surgeon will use something called stereotactic technology to pinpoint the part of your brain that needs treatment.<sup>[99]</sup> Here's how it works.

- A frame is fixed to your head with four pins to keep it still. You'll be given a **local anaesthetic** so you'll be awake but it won't hurt.
- Your surgeon will then create a detailed picture (map) of your brain using one of two types of scans: **magnetic resonance imaging (MRI)** or **computed tomography (CT)**.
- They will then use computer software to find a path through your brain to the exact spot that needs to be treated.

After your surgeon has found the part of your brain that needs treatment, they will:

- Make a cut about 5 centimetres (2 inches) long in your skull
- Put a small **electrode** through the hole into your brain and along the path they've mapped out.

When the tip of the electrode reaches its target, your surgeon will take electrical readings to pinpoint the target exactly. They will then leave the electrode inside your brain. This allows you to stun a tiny part of your brain when your symptoms get bad.

- You may or may not be awake when the electrode is put in your brain. If you're awake, your surgeon will be able to see what happens to your arms, legs, and face muscles when the electrode is switched on. They can then work out exactly where to place the electrode to best control your symptoms.
- Once your surgeon has decided where to put the electrode, they will fix a wire from the electrode to a small machine called an implantable pulse generator.<sup>[114]</sup> This device allows you to control when the electrode in your brain is switched on and off. The pulse generator sends tiny electrical currents through the wire to the brain.
- The operation can take up to eight hours, and you'll need to stay in hospital for about a week. You should be able to see the effects of the operation as soon as you wake up, or when the pulse generator is switched on.
- At a later operation, your surgeon will implant the pulse generator under the skin in your chest (a bit like a heart pacemaker). You'll have a **general anaesthetic**, so you'll be asleep and you won't feel anything.
- After the surgery, you can turn the pulse generator on or off by holding a magnet over it. You'll have to go back to hospital later to fine-tune the generator to best control your symptoms.



## Parkinson's disease

The operation for pallidal deep brain stimulation is reversible, because the brain cells are stunned rather than killed.

Brain surgery is difficult and things can go wrong. Before you decide to have surgery, you should talk to your surgeon about problems that can happen and how likely you are to get these problems. <sup>[101]</sup>

### NICE guidance on deep brain stimulation

Pallidal deep brain stimulation is a newer type of surgery, so we don't know as much about it as we know about [pallidotomy](#). But the National Institute for Health and Care Excellence (NICE), the government body that decides which treatments should be available on the NHS, has decided that deep brain stimulation is safe enough, and works well enough for use in the NHS. <sup>[106]</sup>

For more details, see [NICE guidance on deep brain stimulation](#).

### How can it help?

Two studies found that deep brain stimulation worked better than treatment with medicines, although there was also a bigger risk of side effects. <sup>[115]</sup> <sup>[116]</sup> People in the study had either pallidal deep brain stimulation, [subthalamic deep brain stimulation](#), or treatment with medicines.

In one study: <sup>[115]</sup>

- About 71 in 100 people had fewer movement problems after deep brain stimulation. Only 32 in 100 people taking medicines improved by the same amount
- On average, people who had deep brain stimulation had an extra four-and-a-half hours per day when their symptoms went away (this is called 'on time').

The other study focused on people's quality of life. <sup>[116]</sup> It found that people who had deep brain stimulation had better mobility and were more able to do their daily activities.

There's also some research comparing deep brain stimulation with other kinds of surgery.

- Pallidal deep brain stimulation may work as well as [pallidotomy](#). <sup>[107]</sup> Research on pallidotomy has shown that it can help reduce symptoms of Parkinson's disease, reduce movement problems and reduce 'off time' (when your symptoms come back). <sup>[102]</sup> <sup>[117]</sup> But the study that looked at these two types of surgery was small, so we need more research to find out how these operations compare.
- Pallidal deep brain stimulation may work as well as [subthalamic deep brain stimulation](#). Three studies showed that people who had either type of operation had less movement problems and took less medicine after their operation. <sup>[118]</sup> <sup>[119]</sup> <sup>[120]</sup>

## How does it work?

The part of the brain called globus pallidus is overactive in people with Parkinson's disease.<sup>[109]</sup> Stimulating it should reduce its activity. Then the pathways that carry messages in the brain can work better and your symptoms should improve.

But doctors aren't exactly sure why pallidal deep brain stimulation helps reduce the uncontrolled movements that can happen if you take levodopa for a long time.<sup>[109]</sup>

## Can it be harmful?

Yes. You can have many problems after pallidal deep brain stimulation. These include:  
<sup>[115]</sup> <sup>[118]</sup> <sup>[119]</sup>

- A **stroke**
- Wires moving out of position
- Problems with your sight and speech
- Problems with your movements
- Confusion, or not being able to think as clearly
- Disorientation.

Deep brain stimulation is more likely to cause serious side effects than medicines.<sup>[115]</sup> In one study, 40 in 100 people having deep brain stimulation got a serious problem, including one person who died of bleeding in the brain. Only 11 in 100 people taking medicines got a serious problem.

You may also need another operation to replace equipment or batteries.

But there's some evidence that you're less likely to get side effects after deep brain stimulation than after pallidotomy.<sup>[107]</sup>

## How good is the research on pallidal deep brain stimulation?

We found one study in which one group of people had a [pallidotomy](#) and the other group had pallidal deep brain stimulation.<sup>[107]</sup> The study found no difference in the symptoms in the two groups or in people's ability to do everyday activities. These results suggest that the two types of surgery work equally well. But the study was very small, with only 13 people, so we need more research to confirm the findings.

Three studies have compared bilateral pallidal deep brain stimulation with bilateral [subthalamic deep brain stimulation](#).<sup>[121]</sup> <sup>[122]</sup> <sup>[120]</sup> Two of the studies were small, involving just 55 people altogether. But the third was much larger, with 299 people. The results of

## Parkinson's disease

all three studies suggested that both types of surgery worked as well as each other. But again more research is needed to confirm this.

Two studies found that deep brain stimulation worked better than drugs, but there was also a higher risk of serious side effects. <sup>[115]</sup> <sup>[116]</sup>

---

### Subthalamic deep brain stimulation

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on subthalamic deep brain stimulation?](#)

This information is for people who have Parkinson's disease. It tells you about subthalamic deep brain stimulation, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

#### Does it work?

Subthalamic deep brain stimulation may help your symptoms. But this type of brain surgery can be dangerous. You need to weigh up the risks and benefits by talking to your doctors.

#### What is it?

Subthalamic deep brain stimulation temporarily stuns cells in a part of your brain known as the **subthalamic nucleus**. The aim is to reduce your symptoms of Parkinson's and the uncontrolled movements that can happen when you've been taking the drug levodopa for a long time.

Subthalamic deep brain stimulation is just one type of surgery for Parkinson's disease. To learn about the others, see [Other types of brain surgery](#) .

Before the operation, your surgeon will use something called stereotactic technology to pinpoint the part of your brain that needs treatment. <sup>[99]</sup> Here's how it works.

- A frame is fixed to your head with four pins to keep it still. You'll be given a **local anaesthetic** so you'll be awake but it won't hurt.
- Your surgeon will then create a detailed picture (map) of your brain using one of two types of scans: **magnetic resonance imaging (MRI)** or **computed tomography (CT)**.
- They will then use computer software to find a path through your brain to the exact spot that needs to be treated.

After your surgeon has found the part of your brain that needs treatment, they will:

## Parkinson's disease

- Make a cut about 5 centimetres (2 inches) long in your skull
- Put a small electrode through the hole into your brain and along the path they've mapped out.

When the tip of the electrode reaches its target, your surgeon will take electrical readings to pinpoint the target exactly. They will leave the electrode in your brain. This allows you to stun a tiny part of your brain when your symptoms get bad.

- You'll be awake when the electrode is put in your brain. This allows your surgeon to see what happens to your arms, legs and face muscles when the electrode is switched on. They can then work out exactly where to place the electrode to control your symptoms.
- Once your surgeon has decided where to put the electrode, they will fix a wire from the electrode to a small machine called an implantable pulse generator.<sup>[123]</sup> This machine allows you to control when the electrode in your brain is switched on and off.
- The operation can take up to eight hours, and you'll need to stay in hospital for about a week. You should be able to see the effects of the operation as soon as you wake up, or when the pulse generator is switched on.
- At a later operation, your surgeon will implant the pulse generator under the skin in your chest (a bit like a heart pacemaker). You'll be given a general anaesthetic, so you'll be asleep and you won't feel anything.
- After the surgery, you can turn the pulse generator on or off by holding a magnet over it. You'll have to go back to hospital later to fine-tune the generator to best control your symptoms.

This operation is reversible, because the brain cells are stunned rather than killed.

Brain surgery is difficult and things can go wrong. Before you decide to have surgery, you should talk to your surgeon about problems that can happen and how likely you are to get these problems.<sup>[101]</sup>

### How can it help?

One good-quality study (a randomised controlled trial) showed that people who had subthalamic deep brain stimulation:<sup>[124]</sup>

- Had fewer Parkinson's disease symptoms
- Were able to get more out of life

## Parkinson's disease

- Needed less medicine.

Subthalamic deep brain stimulation seems to work just as well as another type of surgery called [pallidal deep brain stimulation](#).<sup>[125]</sup> <sup>[121]</sup> <sup>[120]</sup> But we need more research to say for sure.

Two other studies found that either subthalamic or pallidal deep brain stimulation worked better than treatment with medicines, although there was also a bigger risk of side effects.

<sup>[115]</sup> In one study:<sup>[115]</sup>

- About 71 in 100 people had fewer movement problems after deep brain stimulation. Only 32 in 100 people taking medicines improved by the same amount
- On average, people who had deep brain stimulation had an extra four-and-a-half hours per day when their symptoms went away (this is called 'on time').

The other study focused on people's quality of life.<sup>[116]</sup> It found that people who had deep brain stimulation had better mobility and were more able to do their daily activities.

### How does it work?

The part of your brain known as the subthalamic nucleus is overactive in people with Parkinson's. Having subthalamic deep brain stimulation stuns a small part of the subthalamic nucleus. The normal circuits in your brain should then start working again and your symptoms should improve.

### Can it be harmful?

The risk of problems is high for this kind of surgery. For example, there is a greater chance of having a [stroke](#) with subthalamic surgery than with other kinds of brain surgery for Parkinson's disease.<sup>[102]</sup>

Doctors also aren't sure whether having surgery on both sides of the brain (bilateral surgery) is safe.<sup>[109]</sup>

Side effects of subthalamic deep brain stimulation include having:<sup>[102]</sup>

- A stroke
- Headaches
- Problems with your speech and sight
- Problems saying or understanding words
- Problems moving around

## Parkinson's disease

- Problems with the wire attached to the electrode
- Problems with the pulse generator.

You may also feel dizzy. Some people don't think as clearly after the operation. <sup>[115]</sup>

In one study, 3 in 78 people who had subthalamic deep brain stimulation died during the study, compared with 1 in 78 people who had medical treatment. One person died of a stroke, and another committed suicide. <sup>[124]</sup>

Deep brain stimulation is more likely to cause serious side effects than medicines. <sup>[115]</sup>  
In one study, 40 in 100 people having deep brain stimulation got a serious problem, including one person who died of bleeding in the brain. Only 11 in 100 people taking medicines got a serious problem.

### How good is the research on subthalamic deep brain stimulation?

There's some good evidence that having subthalamic deep brain stimulation can help your symptoms of Parkinson's. But the research also shows that there are important risks with this treatment.

One good-quality study (a randomised controlled trial) compared subthalamic deep brain stimulation with having drug treatment. <sup>[124]</sup> The study included 156 people. Half the people had this type of surgery and half the people continued taking drug treatment. The study showed that the people who had surgery:

- Had fewer symptoms of Parkinson's disease afterwards, including movement problems
- Were better able to get on with their daily activities, and felt they got more out of life
- Were also able to take smaller doses of medicine to keep their symptoms under control.

But there were important risks. Three people who had surgery died during the study. One person died of a stroke and another committed suicide.

Two other studies compared drug treatment with two types of brain stimulation (subthalamic and [pallidal deep brain stimulation](#)), and found similar benefits and risks. <sup>[115]</sup> <sup>[116]</sup>

Three studies also compared having bilateral (both sides of the brain) pallidal deep brain stimulation with having bilateral subthalamic deep brain stimulation. <sup>[122]</sup> <sup>[121]</sup> <sup>[120]</sup> Both types of surgery seemed to work equally well.

## Parkinson's disease

One study found that deep brain stimulation reduced the amount of time per day that people had movement problems.<sup>[126]</sup> The study included 168 people with Parkinson's disease who had severe movement problems for at least six hours a day.<sup>[126]</sup>

We also found one study that compared having [pallidotomy](#) on one side of the brain (unilateral surgery) with having subthalamic deep brain stimulation on both sides of the brain.<sup>[108]</sup> This study looked at 34 people. It showed that, after six months, the people who had subthalamic deep brain stimulation:

- Had nearly three times greater relief of symptoms than those who had a pallidotomy
- Moved better during 'on' phases
- Had fewer abnormal movements.

---

## Amantadine

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on amantadine?](#)

This information is for people who have Parkinson's disease. It tells you about amantadine, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

We don't know. There hasn't been enough good-quality research to show whether taking amantadine on its own can be helpful in the early stages of Parkinson's disease. Doctors think other drugs probably work better. But taking amantadine can help reduce side effects if you're taking levodopa.

### What is it?

Amantadine is an antiviral drug that was developed to treat [flu](#). But for many years, doctors have thought it can also help people with Parkinson's. The brand names for amantadine are Symmetrel and Lysovir.

### How can it help?

We don't know if it can help. There hasn't been much research to show how well amantadine works in early Parkinson's disease.<sup>[127]</sup>

Guidelines for doctors say that other treatments, including levodopa, dopamine agonists, selegiline, and rasagiline, should be tried first.<sup>[51]</sup>

### How does it work?

Amantadine may increase the amount of **dopamine** released from your brain cells. It may also slow down the removal of dopamine from your brain. But we don't know what effect this has on you. <sup>[52]</sup>

### Can it be harmful?

Amantadine does have some side effects, such as: <sup>[53]</sup>

- Seeing things that aren't there ( **hallucinations** )
- Not being able to sleep
- Having nightmares.

You may also get swollen ankles.

### How good is the research on amantadine?

We didn't find much research that has looked at taking amantadine on its own for the treatment of Parkinson's disease.

---

## Thalamic surgery

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on thalamic surgery?](#)

This information is for people who have Parkinson's disease. It tells you about thalamic surgery, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

We're not sure. This kind of brain surgery may help reduce shaking in the later stages of Parkinson's. But the surgery has a high risk of problems.

### What is it?

There are two types of thalamic surgery. We describe them both below. Today, you are more likely to have the type called deep brain stimulation. It is a newer operation and doctors think it is safer.

Thalamic surgery is just one type of surgery for Parkinson's disease. To learn about others see [Other types of brain surgery](#) .



## Parkinson's disease

Thalamic surgery destroys or temporarily stuns brain cells in a part of your brain known as the **thalamus**. The thalamus sits on both the left and right sides of your brain. You can have surgery on one side (unilateral surgery) or both sides (bilateral surgery). But surgery on both sides isn't common because it has a high risk of side effects.

Before the operation, your surgeon will use something called stereotactic technology to pinpoint the part of your brain that needs treatment.<sup>[99]</sup> Here's how it works.

- A frame is fixed to your head with four pins to keep it still. You'll be given a **local anaesthetic** so you'll be awake but it won't hurt.
- Your surgeon will then create a detailed picture (map) of your brain using one of two types of scans: **magnetic resonance imaging (MRI)** or **computed tomography (CT)**.
- They will then use computer software to find a path through your brain to the exact spot that needs to be treated.

After your surgeon has found the part of your brain that needs treatment, they will:

- Make a cut about 5 centimetres (2 inches) long in your skull
- Put a small **electrode** through the hole into your brain and along the path they've mapped out.

When the tip of the electrode reaches its target, your surgeon will take electrical readings to pinpoint the target exactly. One of two things can happen next. You'll have either a **thalamotomy** or **thalamic deep brain stimulation**.

### Thalamotomy

If you're having a thalamotomy, your surgeon will use electrical energy to destroy some brain cells. To do this, they will heat up the electrode to about 85 degrees Celsius (185 degrees Fahrenheit) to burn the brain cells away.<sup>[100]</sup> Then they will remove the electrode from your brain.

The operation can take up to eight hours, and you'll need to stay in hospital for about a week. You should be able to see the effects of the operation as soon as you wake up.

A thalamotomy cannot be reversed (the brain cells are destroyed).

### Thalamic deep brain stimulation

If you're having thalamic deep brain stimulation, your surgeon will leave the electrode in your brain. This allows you to stun a tiny part of your brain when your symptoms get bad.

- You'll be awake when the electrode is put in your brain. This allows your surgeon to see what happens to your arms, legs, and face muscles when the electrode is

## Parkinson's disease

switched on. They can then work out exactly where to place the electrode to best control your symptoms.

- Once your surgeon has decided where to put the electrode, they will fix a wire from the electrode to a small machine called an implantable pulse generator.<sup>[114]</sup> This device allows you to control when the electrode in your brain is switched on and off.
- The operation can take up to eight hours, and you'll need to stay in hospital for about a week. You should be able to see the effects of the operation as soon as you wake up, or when the pulse generator is switched on.
- At a later operation, your surgeon will implant the pulse generator under the skin in your chest (a bit like a heart pacemaker). You'll have a **general anaesthetic**, so you'll be asleep and you won't feel anything.
- After the surgery, you can turn the pulse generator on or off by holding a magnet over it. You'll have to go back to hospital later to fine-tune the generator to best control your symptoms.

This operation is reversible, because the brain cells are stunned rather than killed.

Brain surgery is difficult and things can go wrong. Before you decide to have surgery, you should talk to your surgeon about problems that can happen and how likely you are to get these problems.<sup>[101]</sup>

### NICE guidance on deep brain stimulation

Thalamic deep brain stimulation is a newer type of surgery, so we know less about it than we know about older operations. But the National Institute for Health and Care Excellence (NICE), the group advising the government on new treatments, has decided deep brain stimulation is safe enough, and works well enough, for use in the NHS.<sup>[106]</sup>

For more details, see [NICE guidance on deep brain stimulation](#) .

### How can it help?

Thalamic surgery mainly helps reduce shaking that's not helped by drugs. It may also help improve stiff muscles.

- In one study, about 9 in 10 people found that their shaking got better after surgery.<sup>[128]</sup> In fact, they had only a little or no shaking after the operation. Results were similar for both thalamotomy (where the brain cells are destroyed) and deep brain stimulation (where the brain cells are stunned).
- Deep brain stimulation works better than thalamotomy to improve how well you can do normal activities.<sup>[128]</sup>

## How does it work?

Surgery to the thalamus interrupts the pathways in the brain involved in producing shaking. After the operation, normal circuits in the brain should work again and the shaking should get better.

## Can it be harmful?

Yes. The risk of problems from thalamic surgery is high.

Thalamotomy has more side effects than deep brain stimulation. In one study, almost 50 percent of the people who had a thalamotomy had problems, compared with less than 20 percent of those who had deep brain stimulation. <sup>[128]</sup>

Here are some other findings. <sup>[129]</sup>

- After a thalamotomy, up to a quarter of people have problems that don't go away. For example, they may get speech problems or even die.
- Between one-third and two-thirds of people who have a thalamotomy get problems that last about three months after their operation. These include confusion, problems saying or understanding words, muscle weakness in their head and neck, and problems moving.
- If you have a thalamotomy on both sides of your brain, you have a greater chance of getting speech problems than if you have the surgery on just one side of your brain.

## How good is the research on thalamic surgery?

There hasn't been much research to say whether thalamic surgery helps people with Parkinson's. We didn't find any good-quality studies (called **randomised controlled trials**) that compared thalamic surgery to treatment with drugs. <sup>[102] [129] [114]</sup>

But we found one summary of the research (called a **systematic review**) that included a study comparing two types of thalamic surgery: <sup>[114]</sup>

- Thalamotomy, which destroys cells in a part of the brain known as the thalamus
- Thalamic deep brain stimulation, which stuns brain cells in the thalamus.

The study included 45 people with Parkinson's disease. <sup>[128]</sup> Six months after treatment:

- About 9 in 10 patients found that their shaking had got better. Results were similar for both thalamotomy and thalamic deep brain stimulation

## Parkinson's disease

- However, those who had thalamic deep brain stimulation were able to function better than those who had a thalamotomy. They also had fewer side effects.

---

## Subthalamotomy

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on subthalamotomy?](#)

This information is for people who have Parkinson's disease. It tells you about subthalamotomy, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

We're not sure. There hasn't been enough research on subthalamotomy so we can't say whether it works. And this type of brain surgery can be dangerous. Doctors don't often do this type of surgery any more because it's too risky, and there are safer methods now.

### What is it?

Subthalamotomy destroys cells in a part of your brain called the **subthalamic nucleus**. The aim is to reduce your symptoms of Parkinson's and the uncontrolled movements that can happen if you've been taking the drug levodopa for a long time.

Subthalamotomy is just one type of surgery for Parkinson's disease. To learn about the others, see [Other types of brain surgery](#).

Before the operation, your surgeon will use something called stereotactic technology to pinpoint the part of your brain that needs treatment. <sup>[99]</sup> Here's how it works.

- A frame is fixed to your head with four pins to keep it still. You'll be given a **local anaesthetic** so you'll be awake but it won't hurt.
- Your surgeon will then create a detailed picture (map) of your brain using one of two types of scans: **magnetic resonance imaging (MRI)** or **computed tomography (CT)**.
- They will then use computer software to find a path through your brain to the exact spot that needs to be treated.

After your surgeon has found the part of your brain that needs treatment, they will:

- Make a cut about 5 centimetres (2 inches) long in your skull

## Parkinson's disease

- Put a small **electrode** through the hole into your brain and along the path they've mapped out.

When the tip of the electrode reaches its target, your surgeon will take electrical readings to pinpoint the target exactly. They will use electrical energy to destroy some brain cells. To do this, they will heat up the electrode to about 85 degrees Celsius (185 degrees Fahrenheit) to burn the brain cells away.<sup>[100]</sup> Then your surgeon will remove the electrode from your brain.

The operation can take up to eight hours, and you'll need to stay in hospital for about a week. You should be able to see the effects of the operation as soon as you wake up.

A subthalamotomy is not reversible (the brain cells are killed). And this operation is rarely done because of serious risks.

Brain surgery is difficult and things can go wrong. Before you decide to have surgery, you should talk to your surgeon about problems that can happen and how likely you are to get these problems.<sup>[101]</sup>

### How can it help?

We're not sure how having subthalamotomy might help you if you have Parkinson's disease. There hasn't been enough research on this type of surgery.<sup>[117]</sup>

### How does it work?

The part of your brain known as the subthalamic nucleus is overactive in people with Parkinson's disease. Subthalamotomy destroys or stuns a small part of your subthalamic nucleus. The normal circuits in your brain should then start working again and your symptoms should improve.

### Can it be harmful?

The risk of problems is high for this kind of surgery. For example, there is a greater chance of having a **stroke** with subthalamotomy than with other kinds of brain surgery for Parkinson's disease.<sup>[102]</sup>

Doctors also aren't sure whether having surgery on both sides of the brain (bilateral surgery) is safe.<sup>[109]</sup>

Side effects of subthalamotomy include:<sup>[130]</sup>

- Infection
- Paralysis on one side of your body (called haemiplegia)
- Problems with your speech

## Parkinson's disease

- Problems with how you think.

### How good is the research on subthalamotomy?

There's little evidence that having subthalamotomy helps people with Parkinson's disease. We didn't find any good-quality studies (called [randomised controlled trials](#) ) that compared having subthalamotomy with drug treatment. <sup>[117]</sup>

A large study called PD SURG is taking place in the UK. Its results will give us more information about how well surgery works for Parkinson's disease. <sup>[131]</sup>

---

## Physiotherapy

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on physiotherapy?](#)

This information is for people who have Parkinson's disease. It tells you about physiotherapy, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

We're not sure. You may find it helpful. But there's not much research on whether physiotherapy helps people with Parkinson's disease.

### What is it?

Physiotherapy takes many forms. It usually involves exercises or treatments that can help you keep moving and doing things for yourself for as long as possible. You can ask your GP or consultant to refer you to a [physiotherapist](#) .

A physiotherapist will look at how Parkinson's disease affects you. This is called an assessment. You may then be offered a combination of advice and treatment. Your treatment may involve: <sup>[132]</sup> <sup>[133]</sup>

- Walking exercises and other exercises to help you move better
- Advice on new ways to do everyday tasks
- Therapy to help you relax
- Breathing exercises.

## Parkinson's disease

The National Institute for Health and Care Excellence (NICE), which advises the government about which treatment works best, says everyone with Parkinson's disease should be offered physiotherapy. <sup>[134]</sup>

### How can it help?

The aim of physiotherapy is to help you keep moving and doing things for yourself as much as possible.

Physiotherapy may improve: <sup>[132]</sup> <sup>[135]</sup>

- The way you walk
- How you feel about yourself
- How you cope from day to day.

One review of studies looked at using a treadmill to help people walk better. The researchers found that people's walking speed, stride length, and walking distance improved after this type of therapy. <sup>[136]</sup> Another review suggested that exercises focused on improving muscle strength can help people walk farther. <sup>[137]</sup>

Regular exercise and sport may also improve your movements and your mood. <sup>[17]</sup>

But physiotherapy cannot change the main symptoms of Parkinson's disease, including shaking, stiff muscles, and slow movement. <sup>[132]</sup> <sup>[138]</sup> Physiotherapy is not a substitute for treatment with drugs.

### How does it work?

Physiotherapy will not stop your disease from getting worse. But it may strengthen your body and improve the way you do everyday tasks. As a result, you should be able to cope better day-to-day and do more things for yourself.

### Can it be harmful?

There have been no reports of any dangers from physiotherapy in people with Parkinson's disease.

### How good is the research on physiotherapy?

There's not enough good-quality research to say what kind of physiotherapy helps in either the early or later stages of Parkinson's disease.

We looked at four summaries of the research (called **systematic reviews**). <sup>[135]</sup> <sup>[132]</sup> <sup>[136]</sup>  
<sup>[137]</sup>

## Parkinson's disease

Many of the studies included in the summaries were small. They also used different methods. So it's difficult to compare them and draw any conclusions about physiotherapy for Parkinson's.

Still, doctors agree that physiotherapy can help patients, and it's safe.

We need bigger studies to find out what kinds of physiotherapy work best.

---

## Occupational therapy

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on occupational therapy?](#)

This information is for people who have Parkinson's disease. It tells you about occupational therapy, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

We're not sure. There's not enough evidence to tell us how occupational therapy might help people with Parkinson's.

### What is it?

An occupational therapist will help you adapt to the changes in your life caused by Parkinson's. <sup>[139]</sup> The goal is to allow you to carry on with activities that are important to you.

For example, you may get advice on:

- Personal care (for example, how to get dressed, brush your teeth, and do shopping)
- Work (how to continue doing either paid or unpaid jobs, including housework)
- Leisure activities (how to participate in hobbies, sport, and other social activities).

An occupational therapist will first pinpoint what activities are difficult for you because of Parkinson's. The therapist can then assist you by:

- Working out a daily or weekly routine with you (you may need to plan your day and keep things simple)
- Teaching you or your family new ways to cope and how to do things differently



## Parkinson's disease

- Recommending equipment to use at home or work so that you can carry out your everyday activities
- Exploring transport options and things you can do in your leisure time
- Helping you keep up your social life and putting you in touch with other people with Parkinson's disease.

The National Institute for Health and Care Excellence (NICE), which advises the government about which treatments work best, says everyone with Parkinson's disease should be offered occupational therapy. <sup>[140]</sup>

### How can it help?

Getting advice from an occupational therapist may:

- Improve your quality of life
- Improve the way you manage your everyday activities
- Improve your mood.

Special equipment can also make life easier. <sup>[141]</sup> For example:

- Velcro fasteners are easier to use than zips and buttons
- Front-fastening bras are simpler than back-fastening bras
- Slip-on shoes are better than those with laces
- Large-handled knives, forks, and spoons are easier to grip than ordinary cutlery
- Grab rails fitted near your bed and in the bathroom can help you stand and steady yourself.

But occupational therapy cannot cure you. And it does not change the main symptoms of Parkinson's disease, including shaking, stiff muscles and slow movement. Occupational therapy is not an alternative to treatment with drugs.

### How does it work?

Support and practical advice from an occupational therapist should help you continue with your normal activities for as long as possible. <sup>[139]</sup> An occupational therapist will also suggest new interests that you can manage.

## Parkinson's disease

Special equipment may help you adapt as your movement becomes more difficult to control.

### Can it be harmful?

There have been no reports of dangers from occupational therapy for people with Parkinson's disease.

### How good is the research on occupational therapy?

There's not enough good-quality evidence to say what kind of occupational therapy helps people in the later stages of Parkinson's disease. We found one summary of the research (known as a [systematic review](#) ) that covered two studies involving 84 people. <sup>[139]</sup>

One of the studies used everyday activities to help people stay mobile, sociable and able to do daily tasks. The other study involved sessions of handicrafts, drawing, basket weaving, folk singing, dancing, and games.

Both studies reported small improvements from the therapy. But it's impossible to tell the actual effects of occupational therapy because the studies had the following problems:

- They were small
- They were not well-designed
- They used different kinds of occupational therapy, so it's hard to compare their results
- They measured results in many different ways.

Larger and better studies are needed to know how occupational therapy can help people with Parkinson's disease.

---

## Speech and language therapy

In this section

[Does it work?](#)

[What is it?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on speech and language therapy?](#)

This information is for people who have Parkinson's disease. It tells you about speech and language therapy, a treatment used for Parkinson's. It is based on the best and most up-to-date research.

### Does it work?

We're not sure. You may find it helpful. But there's not enough good research to say whether speech and language therapy can help people with Parkinson's.

# Parkinson's disease

## What is it?

About half of all people with Parkinson's have problems speaking at some time. <sup>[142]</sup>

For example, they may:

- Speak too softly and quietly
- Hesitate and find it difficult to start talking
- Fade away
- Lack variety and expression when they talk
- Tremble or be hoarse
- Speak too quickly.

A speech and language therapist can show you ways to speak more clearly again: <sup>[142]</sup>

- The therapist will watch the way you breathe and how you move your lips, jaw, and tongue to form words.
- They may then show you how to breathe differently so that it doesn't interrupt your speech.
- The therapist may also give you advice and exercises to retrain your voice.

## Making the most of your voice

When you talk, try to remember the following: <sup>[142]</sup>

- Relax. Sit or stand comfortably.
- Keep your sentences short.
- Don't repeat what you said if someone doesn't understand you. Think of another way to say it.
- You may have to make your tongue, lips, and jaw work harder to produce all your words clearly.
- Always try to imagine that you are speaking in a bigger room than you are. This will train you to use a loud voice.

## Parkinson's disease

- Remember that it is better to feel as though you are speaking too loudly than too softly.

### Talking to people with Parkinson's

If you know someone with Parkinson's, there are things you can do to help the person communicate. Try to remember the following: <sup>[142]</sup>

- Give them time.
- Don't pretend to understand if you haven't.
- If you don't understand something, ask them to repeat what they've said in another way.
- Don't finish sentences for them or interrupt.
- Talk normally. Don't shout.
- Keep your questions simple, with one idea per question.
- Talk face to face.

The National Institute for Health and Care Excellence (NICE), which advises the government about which treatments work best, says everyone with Parkinson's disease should be offered speech and language therapy. <sup>[143]</sup>

Speech therapy may help you retrain your voice so that people can understand you better. You may then be less embarrassed and frustrated about the way you talk. This could also help improve your self-esteem.

But you probably won't see dramatic improvements in the way you speak. <sup>[144]</sup>

### How does it work?

Your voice box (larynx) may not work as well if you have Parkinson's, especially if you're in the later stages of the disease. Your voice may sound hoarse, slurred, quiet, and unvaried. These problems happen when the muscles that control your speech become damaged.

Speech therapy can help you retrain your voice and breathe at the right time when you talk. This should make your speech easier to understand.

### Can it be harmful?

There's no evidence of any harmful side effects from speech and language therapy.

### How good is the research on speech and language therapy?

There's not enough good-quality evidence to say whether speech and language therapy can help the speech problems that are common in the later stages of Parkinson's.

We found one summary of the research (known as a [systematic review](#)) that included three studies with 63 people. <sup>[144]</sup>

- One study looked at the impact of a device that gives visual feedback on how you speak (this device is called a Vocalite machine).
- Another study compared therapy to change how you breathe when you speak (respiration therapy) and therapy to make you speak louder by 'thinking loud' and increasing your breathing (called the Lee Silverman Voice Treatment).

But it's impossible to say which method works best. <sup>[145]</sup> The studies were not reliable because:

- They included too few people
- They weren't well-designed
- They measured people's responses to treatments in different ways. This makes it difficult to compare their results.

---

## Swallowing therapy

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on swallowing therapy?](#)

This information is for people who have Parkinson's disease. It tells you about swallowing therapy, a treatment used for Parkinson's disease. It is based on the best and most up-to-date research.

### Does it work?

We don't know. You may find it helpful. But we couldn't find any good-quality studies to say what therapy might help people with Parkinson's who have difficulty swallowing.

### What is it?

Many people with Parkinson's get problems with swallowing, especially in the later stages of the disease. Because of this, they may: <sup>[146]</sup>

## Parkinson's disease

- Lose their appetite
- Lose weight
- Get food stuck in their throat
- Get a gurgly cough or a gurgly voice
- Choke on food, drink, or saliva
- Have problems swallowing medicine
- Find it uncomfortable or painful to swallow
- Get heartburn
- Have chest infections
- Start drooling or dribbling.

Difficulty swallowing can also lead to the following serious problems.<sup>[146]</sup>

- Choking: This happens when food goes down your airways instead of your throat.
- Pneumonia: If food gets stuck in your airways, it can trap **bacteria** there. This can lead to **pneumonia** .
- Undernourishment: If you don't eat or drink enough, your body isn't getting the energy, vitamins, minerals, and fluids that it needs to work properly.

Speech and language therapists are experts on swallowing as well as on how to speak. They can look at your swallowing problems and may give you some exercises to help overcome them. For example, they might suggest you change the position of your chin, strengthen your face and tongue muscles, or improve the way you breathe.

Dietitians can also give you advice on how to make food more appetising and easier to swallow.

Here are some points on how to swallow safely.<sup>[146]</sup>

- Never swallow with your head tilted backwards. Lower your chin towards your chest to reduce the chance of food going down the wrong way.
- Take small mouthfuls.
- Take your time.

## Parkinson's disease

- Cold drinks can help you swallow. Try a cold drink first thing in the morning or with a meal.
- Don't empty your glass. Refill your glass when it's half full so you don't need to tilt your head backwards to drink.

### How can it help?

By overcoming swallowing problems, you can help your body get the energy, vitamins, minerals, and fluids that it needs. Swallowing therapy may also make your mealtimes safer and more enjoyable. <sup>[146]</sup>

### How does it work?

The muscles in your jaw and face can become weak if you have Parkinson's. You may have less control over your teeth and not be able to close your lips tightly. This makes it hard to chew your food and swallow. Food and saliva may collect in your mouth and in the back of your throat, causing you to choke or dribble.

Although the drug levodopa can improve your swallowing speed, drugs don't help much with these swallowing problems. <sup>[147]</sup> So therapy is used to improve how you swallow and to strengthen the muscles you need for swallowing. Other advice, such as changing the texture of your food, may also make swallowing easier and safer for you.

For some people, though, swallowing therapy may not be enough. They may need another way to nourish their body, such as a feeding tube through their nose or directly into their stomach.

### Can it be harmful?

Probably not. But we can't say for certain since there's no good research on swallowing therapy for people with Parkinson's.

### How good is the research on swallowing therapy?

We couldn't find any good-quality studies on swallowing therapy.

---

## Anticholinergic drugs

In this section  
[What are they?](#)  
[Side effects](#)

This information is for people who have Parkinson's disease. It tells you about anticholinergic drugs, a treatment used for Parkinson's.

We haven't looked at the research on anticholinergic drugs in the same detail we have for the other treatments we cover. (For more, see Our method.) But we wanted to include some information because you may be interested.

# Parkinson's disease

## What are they?

Anticholinergic drugs block the activity of a substance in the body called acetylcholine. Like dopamine, acetylcholine is a neurotransmitter. It carries messages between nerve cells. But it doesn't play a big role in Parkinson's.

Until drugs were discovered that work on dopamine, anticholinergic drugs were used quite a lot to treat Parkinson's. Now, they tend to be used early on in Parkinson's so you don't need to use levodopa so soon. <sup>[148]</sup>

They work better at treating tremor than they do for the other symptoms of Parkinson's. <sup>[148]</sup> <sup>[21]</sup> They also help to treat muscle spasms in the foot in people who get Parkinson's at a young age. <sup>[52]</sup>

Anticholinergic drugs are also used to treat people who have developed Parkinson's after taking certain antipsychotics. Antipsychotics are used to treat schizophrenia and sometimes other mental illnesses.

Anticholinergic drugs used in the UK are: <sup>[93]</sup>

- procyclidine (brand names Arpicolin and Kemadrin)
- orphenadrine (brand names Biorphen and Disipal)
- trihexyphenidyl (also called benzhexol) (brand name Broflex)
- benztropine (brand name Cogentin).

## Side effects

These drugs can cause the following side effects:

- Problems with vision ( glaucoma )
- Dry mouth
- Bladder problems
- Constipation.

Some people become confused and find it hard to concentrate when they take anticholinergic drugs. For this reason they need to be used very carefully in older people who may already have some memory and other neurological problems. <sup>[93]</sup>

---

## Other types of brain surgery



# Parkinson's disease

In this section

This information is for people who have Parkinson's disease. It tells you about surgery for Parkinson's.

Surgery was once the main treatment for people with Parkinson's disease. But the drug [levodopa](#) took over when it was introduced in 1967.

However, levodopa is not perfect. It can cause side effects, especially movements you can't control (called dyskinesias and dystonia). So, doctors started to look at surgery again.

The techniques used today are much safer than those used in the past. This is because doctors have better ways of taking accurate pictures of the brain (known as neuroimaging). This allows them to pinpoint exactly where to do the surgery.

But surgery isn't for everybody. Your doctor will recommend surgery only if you've had Parkinson's for a long time and drug treatments aren't helping your symptoms any more. Here are some things to think about.

- Surgery cannot cure Parkinson's.
- It won't stop your disease from progressing.
- But surgery can ease some of your symptoms, especially stiff muscles, shaking, and movements you can't control.
- You'll need to keep taking drugs for Parkinson's after surgery.
- We don't know how long the benefits of surgery will last. It might be a year or two, or longer.

Here's an overview of some of the types of surgery. There's good research on lesioning and deep brain stimulation. We cover these in detail elsewhere (please see the links below). But the other types of surgery are still experimental. This means that they're mainly used in studies, and there isn't much research to tell us how well they work, or how safe they are.

## Lesioning

Today, doctors don't often use this type of surgery. It is considered too risky, and there are now safer methods. <sup>[149]</sup> Lesioning uses electricity to destroy the overactive nerve cells in your brain that are causing your symptoms. <sup>[100]</sup> The surgeon puts an **electrode** into your brain and heats it up to 85 degrees Celsius (185 degrees Fahrenheit). This burns a small hole (or lesion) several millimetres wide.

Lesioning can be done on three different parts of the brain. <sup>[149]</sup>

## Parkinson's disease

- Lesioning on the thalamus: this operation is called **thalamotomy**, and it is usually only done on one side of your brain. Thalamotomy is mainly used to treat shaking and stiff muscles. To learn more, see [Thalamic surgery](#) .
- Lesioning on the globus pallidus: this operation is called **pallidotomy**. It is done to speed up slow movements as well as help the movement problems that some people get when they take Parkinson's drugs for a while. To learn more, see [Pallidotomy](#) .
- Lesioning on the subthalamus: this is called **subthalamotomy**. This can ease many symptoms of Parkinson's. But the subthalamus is a dangerous part of the brain to operate on, so this surgery isn't done as often as the other operations. To learn more, see [Subthalamotomy](#) .

### Deep brain stimulation

This uses electricity to 'turn off' overactive brain cells. It involves fixing an electrode inside your brain. A wire connects the electrode to a device called an implantable pulse generator, which is put inside your chest.<sup>[123]</sup> The pulse generator releases a tiny electrical current through the wire and into your brain to stop certain brain cells causing the symptoms of Parkinson's.

The advantage of this type of surgery is that, unlike lesioning, it doesn't destroy a part of the brain. Lesioning can cause problems if the wrong part of the brain or too much of the brain is damaged.

As with lesioning, deep brain stimulation can be done on the thalamus (see [Thalamic surgery](#) ), the globus pallidus (see [Pallidal deep brain stimulation](#) ) or the subthalamus (see [Subthalamic deep brain stimulation](#) ).

### Gamma knife surgery

Like lesioning, this type of surgery destroys some brain cells. But instead of using electricity to kill the cells, the surgeon uses a type of energy called gamma radiation.<sup>[149]</sup>

You won't need a cut in your skull for this type of surgery because the gamma rays go through your skull and into your brain. However, there is a downside. It can take weeks or even months to know if the surgery has worked. Because of this, doctors think gamma knife surgery isn't yet safe enough to use.

### Cell transplants

In this type of surgery, nerve cells in your brain that have died are replaced with new cells.<sup>[149]</sup>

The first experiments have involved putting cells from human fetuses or animals into the brain. The aim is that the new cells will start making **dopamine** (people with Parkinson's don't have enough of this **neurotransmitter** ).

## Parkinson's disease

Results so far have been mixed, and this technique is only used in studies. Also, there are ethical concerns about using tissue from human fetuses.

### **GDNF (glial cell line derived neurotrophic factor) surgery**

Researchers have been looking at putting a growth factor into the brain of people with Parkinson's disease. (Growth factors are substances in your body that tell specific cells to grow.) The growth factor (called glial cell line derived neurotrophic factor) encourages certain nerve cells to grow. But this treatment is in the early stages and there is little information about whether it works or is safe.

---

### **Further informations:**

#### **Problems linked with Parkinson's disease**

##### **Depression**

Many people with Parkinson's get depressed.<sup>[10]</sup> You may get depressed early on in the disease, before you notice other symptoms.

You may not be severely depressed. But side effects of the drugs used to treat Parkinson's can make depression worse.

Explain how you're feeling to your doctor. Antidepressants can help you feel better.

##### **Emotional changes**

When you find out you have Parkinson's disease, you may feel anxious or frightened.<sup>[10]</sup> You may also lose your motivation and become more dependent on your family.<sup>[11]</sup>

Joining a support group may help you cope emotionally. You can get advice and support from other people with Parkinson's disease and their carers.

##### **Difficulty in swallowing and chewing**

The muscles you use for swallowing may not work as well later on in the disease.<sup>[10]</sup> If this happens, food and saliva can collect in the back of your throat. This can cause choking or drooling. You may find [swallowing therapy](#) helpful.

##### **Speech changes**

About half of the people with Parkinson's disease have problems with their speech.<sup>[10]</sup> They may talk too softly, speak without much variation in their voice, or slur their words.

If your speech has changed, [speech and language therapy](#) might help you speak more clearly.

## Parkinson's disease

### Constipation

Most people with Parkinson's disease have problems with constipation.<sup>[10]</sup> This is because the movement of their muscles slows down, including the muscles of their gut.

Don't let your constipation last for several days. Ask your doctor for help.

### Skin problems

Your skin can become greasy or too dry.<sup>[10]</sup> You might also sweat a lot. Creams and other treatments for skin problems may help.

### Sleep problems

You may have difficulty sleeping at night and then feel drowsy during the day.<sup>[12] [13]</sup> It's unclear if sleep problems are caused by the disease or the drugs you take. There are treatments for sleep problems that you can buy at a pharmacy, but it's best to talk to your doctor before taking them.

### Dementia

About 1 in 5 people with Parkinson's disease get forgetful and confused. Their personality and behaviour can also be affected. This is called dementia.<sup>[14]</sup>

There is a chance, especially if you're older, that you can have both Parkinson's disease and dementia. This combination makes treatment difficult.

If you're caring for someone with both conditions, make sure you have support so you aren't shouldering the care all by yourself.<sup>[15]</sup>

### Problems driving

You should tell the DVLA (Driver and Vehicle Licensing Authority) and your insurance company if you have Parkinson's disease. Your insurance may be invalid if you don't.<sup>[16]</sup>

## How doctors treat Parkinson's disease

Treating Parkinson's disease is complicated. The drug levodopa can work well at first. You may even forget you have the disease when you start taking it.<sup>[18]</sup> But after taking levodopa for two to five years, you may get serious problems from the drug. About half of all people do.<sup>[19]</sup>

When doctors treat Parkinson's disease they are trying to control the symptoms. What they would really like to do is to stop the brain cells from being destroyed. When brain cells are prevented from dying it's called **neuroprotection**. However, none of the treatments available at the moment has been shown to protect brain cells in this way.

## Problems with levodopa

### Wearing off

This happens when your levodopa dose becomes less effective, so it wears off more quickly. For example, you may notice your symptoms are worse than they used to be before your first dose in the morning. Your muscles might also start to stiffen or your hands might start to tremble before your next dose is due.

### On-off effect

Your symptoms may come back and go away suddenly. When your symptoms come back, this is called 'off time'. Off times may last a few minutes or hours. When your symptoms go away, this is called 'on time'.

People who look after someone with Parkinson's say the effect is like a light being switched on and off. One minute the person is joining in with conversation and other people, and the next minute they freeze and go quiet. Off times can happen several times a day. They are not related to when you take your medicine.

### Movements you can't control

These can happen just before or after you take your dose of levodopa, or midway between two doses. You may nod your head over and over again. Or you may jerk your leg, smack your lips or make a strange face. You may also move your body into strange positions. Doctors call these movements:

- Dyskinesias (abnormal jerking movements)
- Dystonia (a type of movement problem that causes abnormal twisting and body positions).

These problems may not go away even with changes to your medication.

However, some of the movements might not be related to levodopa. They could be a part of a later stage of Parkinson's. <sup>[20]</sup> <sup>[21]</sup>

## Ways to use levodopa

Because of the problems that can happen with levodopa, your doctor may try to delay when you start taking the drug. For example, you may start on another type of drug called a dopamine agonist. You may also take other drugs with levodopa to make it work better.

What treatment you take also depends on your symptoms and how the disease affects your life.

Here are some treatment options.

### Using a different drug first

Your doctor may start you on another drug before levodopa. For example, you may take a drug called selegiline (brand names Eldepryl and Zelapar), rasagiline (Azilect) or a dopamine agonist. This can improve your symptoms and stop levodopa being necessary for a while. To read more, see [Selegiline and rasagiline](#) and [Dopamine agonists](#) .

### Using levodopa occasionally

Your doctor may give you levodopa only when your symptoms get quite bad (doctors call this rescue medication or rescue levodopa). This is especially likely if your symptoms don't bother you much. But if your symptoms are causing you difficulty, you may start taking levodopa regularly even if your symptoms are only mild.

### Starting levodopa earlier if you're older

If you're over 70, you may start taking levodopa soon after you get symptoms. But there is still debate about when older people should start taking levodopa. There is a large clinical trial in the UK called PD MED looking at this issue.<sup>[22]</sup> Your doctor may ask you to help with this study.

### Taking levodopa more often (if it wears off)

If your symptoms come back between your doses of levodopa, your doctor may advise you to take your medicine more often. For example, you might take it six times a day instead of three times.

You can also take levodopa as extended-release and controlled-release tablets or capsules. If you take this type of levodopa, you may not need to take tablets as often because the levodopa is released gradually into your body over several hours. But there's no evidence that taking levodopa in this form works better than ordinary levodopa tablets that release the drug straight away.<sup>[22] [23]</sup> After five years, people with early Parkinson's disease who took either the slow- or quick-release levodopa tablets had similar symptoms.

Madopar also comes in tablets that can be dissolved in water or orange squash (but not orange juice). It can give you a kick start in the morning, because the drug is absorbed more quickly than normal tablets. It's also useful if you are having problems swallowing tablets or capsules.

### Using other drugs to make levodopa work better

If you're in the early stages of Parkinson's, your doctor may give you a dopamine agonist before levodopa. This can delay the time that you need to start taking levodopa. For more information, see [Dopamine agonists](#) .

Another option in the early stages of Parkinson's is to take anticholinergic drugs to control tremor. These drugs are often used to treat people who get Parkinson's at a younger age than normal, and who have a problem with muscle spasms in their feet. They are

## Parkinson's disease

also sometimes used for Parkinson's-like symptoms caused by certain drugs that are used to treat mental illness. For more information, see [Anticholinergic drugs](#) .

If you've been taking levodopa for a while and start getting movements you can't control, your doctor might reduce your dose and add a dopamine agonist. For more information, see [Adding a dopamine agonist to levodopa](#) . Or you might be given a drug called amantadine. For more information, see [Levodopa and amantadine](#) .

Your doctor might also give you a drug called entacapone (brand name Comtess) or one called tolcapone (brand name Tasmar) with levodopa. Entacapone and tolcapone stop levodopa being broken down by your body as quickly as usual. This means that more levodopa reaches your brain. Promising results have been reported. For more information, see [Levodopa plus entacapone or tolcapone](#) .

### When should I start taking levodopa?

There's no one right time to start taking levodopa. It all depends on how you are coping with your symptoms. If your symptoms are causing problems in your life, you need to start taking some type of drug to help, such as levodopa or a dopamine agonist.

Studies that have been done on levodopa have looked at treating people who are in the early stages of Parkinson's. <sup>[24]</sup> <sup>[25]</sup> <sup>[26]</sup> <sup>[27]</sup> <sup>[28]</sup> <sup>[29]</sup> <sup>[30]</sup> These suggest that if you take levodopa early on in your disease, the drug may start wearing off or causing side effects sooner than if you start taking the drug later on. To read more, see [Levodopa](#) .

## Diseases that look like Parkinson's

About 1 in 10 people with symptoms that look like Parkinson's disease don't have Parkinson's disease. <sup>[4]</sup> They have another problem instead.

Doctors may call these problems **parkinsonism**, because they look like Parkinson's disease.

Here are some things that cause symptoms similar to Parkinson's. <sup>[36]</sup>

### Medicines

Some drugs, especially those used to treat mental illnesses, nausea, or dizziness, can cause symptoms that look like Parkinson's, such as trembling. The symptoms may go away when you stop taking the drugs.

### Multiple strokes

This happens when the blood supply to the brain is disrupted by lots of little **strokes** . The brain is damaged slowly and over a long period of time from the small strokes. The damage can cause symptoms similar to Parkinson's disease.

# Parkinson's disease

## Other conditions

The symptoms of Parkinson's may appear in people with other diseases that lead to a decrease of dopamine in the brain. Brain cells use dopamine to send messages to other parts of the brain, and to nerves and muscles throughout your body. To learn more, see [What is Parkinson's disease?](#)

These diseases include:

- Alzheimer's disease
- Creutzfeldt-Jakob disease
- Huntington's disease
- Progressive supranuclear palsy
- Multisystem atrophy
- Wilson's disease
- Corticobasal degeneration .

## Harmful substances

Some harmful substances such as manganese and carbon monoxide can cause symptoms that look like Parkinson's. The symptoms usually go away when the substance is removed.

## Post-encephalitic parkinsonism

This is when people get symptoms that look like Parkinson's disease after having an infection in their brain caused by a virus . It's very rare today.

However, in the 1920s many people got an infection called sleeping sickness. Many of those who recovered then got symptoms of Parkinson's disease weeks or years later. The film *Awakenings* recounts how the drug levodopa was able to temporarily awaken some people in a New York hospital.

## Parkinsonism caused by repeated knocks to the head

This can happen to boxers who have suffered brain damage because of repeated blows to the head.



## NICE guidance on deep brain stimulation

The National Institute for Health and Care Excellence (NICE), the government body that decides which treatments should be available on the NHS, says that when doctors use deep brain stimulation for people with Parkinson's disease they should: <sup>[106]</sup>

- Make sure you understand the benefits and risks
- Only do the operation when drug treatment isn't working any more
- Treat you within a team of doctors and other health professionals with a range of different skills in a hospital department called a neuroscience unit. A doctor specialising in diseases that affect the nerves (a neurologist), a brain surgeon (neurosurgeon), and psychologists should be included in the team
- Monitor the results of your surgery.

### Glossary:

#### dopamine

Dopamine is a neurotransmitter, which is a chemical that helps messages pass between brain cells and other cells. Dopamine plays a role in your mood, and your physical movements.

#### genes

Your genes are the parts of your cells that contain instructions for how your body works. Genes are found on chromosomes, structures that sit in the nucleus at the middle of each of your cells. You have 23 pairs of chromosomes in your normal cells, each of which has thousands of genes. You get one set of chromosomes, and all of the genes that are on them, from each of your parents.

#### antidepressant

Antidepressants are medicines used to treat depression and sometimes other conditions. They work by changing the levels of chemicals in your brain called neurotransmitters. There are three main types of antidepressants, which work in different ways: selective serotonin reuptake inhibitors (SSRIs), monoamine oxidase inhibitors (MAOIs) and tricyclic antidepressants (TCAs).

#### constipated

When you're constipated, you have difficulty passing stools (faeces). Your bowel movements may be dry and hard. You may have fewer bowel movements than usual, and it may be a strain when you try to go.

#### dementia

Dementia is when your brain stops working properly. Someone with dementia may become gradually more confused and forgetful. A common cause of dementia is Alzheimer's disease.

#### neurotransmitters

Neurotransmitters are chemicals that help to carry messages between nerve cells. Serotonin, dopamine, and norepinephrine (noradrenaline) are all neurotransmitters.

#### neurologist

A neurologist is a doctor who specialises in diseases that affect your brain and your nervous system.

#### MRI scan

A magnetic resonance imaging (MRI) machine uses a magnetic field to create detailed pictures of the inside of your body.

#### stroke

You have a stroke when the blood supply to a part of your brain is cut off. This damages your brain and can cause symptoms like weakness or numbness on one side of your body. You may also find it hard to speak if you've had a stroke.

#### Alzheimer's disease

People who have Alzheimer's disease slowly lose their memory and ability to think clearly. As the disease gets worse, they get more confused and start acting differently. Several changes happen in the brain that stop it working properly. Small lumps called amyloid

# Parkinson's disease

plaques grow in the parts of the brain used for memory and thinking. And bundles of twisted threads called 'neurofibrillary tangles' form inside brain cells. These stop brain cells communicating with each other, and they can cause cells to die. Also, in Alzheimer's disease, the brain does not have enough chemical messengers (neurotransmitters), and holes or gaps appear where brain cells have died.

## **Creutzfeldt-Jakob disease**

Creutzfeldt-Jakob disease (CJD) is a brain disease. It's caused by a rare type of infection. CJD causes problems with memory, co-ordination and mood. The disease gets worse until the person can't move or speak.

## **Huntington's disease**

This disease of the brain causes uncontrolled movements, emotional problems, and problems with walking, talking and thinking. It is inherited (passed on in your genes). Symptoms don't usually start before people are in their 40s or 50s. There is no treatment.

## **progressive supranuclear palsy**

This is a rare disease that affects your brain. People with this condition have problems with their vision, walking and balance.

## **multisystem atrophy**

Multisystem atrophy is a rare disease that damages the nerves that control things your body does automatically (such as the rate at which your heart beats). The disease can cause dizziness, fainting when you stand up, tremors and other problems with your nervous system.

## **Wilson's disease**

Wilson's disease is a disease that causes copper to build up in your liver or brain. It most commonly leads to liver damage, but it can also cause shaking, stiffness, difficulties with speech and other problems with your brain. The disease is inherited (it is passed on in the genes you get from your parents).

## **corticobasal degeneration**

In this disease, the parts of your brain that control movement and speech gradually stop working. People usually start getting symptoms of corticobasal degeneration between the ages of 60 and 70 years old. At first, it makes you become stiff and move more slowly. Then, you become uncoordinated and tend to slur your speech and get muscle spasms.

## **infection**

You get an infection when bacteria, a fungus, or a virus get into a part of your body where it shouldn't be. For example, an infection in your nose and airways causes the common cold. An infection in your skin can cause rashes such as athlete's foot. The organisms that cause infections are so tiny that you can't see them without a microscope.

## **viruses**

Viruses are microbes (tiny organisms) that need the cells of humans or other animals to exist. They use the machinery of cells to reproduce. Then they spread to other cells in the body.

## **physiotherapy**

Physiotherapy is a way of using movements or exercises to help people's bodies heal.

## **placebo**

A placebo is a 'pretend' or dummy treatment that contains no active substances. A placebo is often given to half the people taking part in medical research trials, for comparison with the 'real' treatment. It is made to look and taste identical to the drug treatment being tested, so that people in the studies do not know if they are getting the placebo or the 'real' treatment. Researchers often talk about the 'placebo effect'. This is where patients feel better after having a placebo treatment because they expect to feel better. Tests may indicate that they actually are better. In the same way, people can also get side effects after having a placebo treatment. Drug treatments can also have a 'placebo effect'. This is why, to get a true picture of how well a drug works, it is important to compare it against a placebo treatment.

## **randomised controlled trials**

Randomised controlled trials are medical studies designed to test whether a treatment works. Patients are split into groups. One group is given the treatment being tested (for example, an antidepressant drug) while another group (called the comparison or control group) is given an alternative treatment. This could be a different type of drug or a dummy treatment (a placebo). Researchers then compare the effects of the different treatments.

## **physiotherapist**

A physiotherapist is a health professional who is trained to use physical activity and exercises to help people's bodies heal.

## **systematic reviews**

A systematic review is a thorough look through published research on a particular topic. Only studies that have been carried out to a high standard are included. A systematic review may or may not include a meta-analysis, which is when the results from individual studies are put together.

## **diarrhoea**

Diarrhoea is when you have loose, watery stools and you need to go to the toilet far more often than usual. Doctors say you have diarrhoea if you need to go to the toilet more than three times a day.

# Parkinson's disease

## **inflammation**

Inflammation is when your skin or some other part of your body becomes red, swollen, hot, and sore. Inflammation happens because your body is trying to protect you from germs, from something that's in your body and could harm you (like a splinter) or from things that cause allergies (these things are called allergens). Inflammation is one of the ways in which your body heals an infection or an injury.

## **ultrasound**

Ultrasound is a tool doctors use to create images of the inside of your body. An ultrasound machine sends out high-frequency sound waves, which are directed at an area of your body. The waves reflect off parts of your body to create a picture. Ultrasound is often used to see a developing baby inside a woman's womb.

## **X-ray**

X-rays are pictures taken of the inside of your body. They are made by passing small amounts of radiation through your body and then onto film.

## **hallucinations**

If you have hallucinations, you perceive things that aren't really there. You may see things that don't exist or hear voices when nobody's talking. Or you may get a crawling feeling on your skin when there isn't anything on it. Hallucinations can make you feel frightened and agitated.

## **liver**

Your liver is on the right side of your body, just below your ribcage. Your liver does several things in your body, including processing and storing nutrients from food, and breaking down chemicals, such as alcohol.

## **local anaesthetic**

A local anaesthetic is a painkiller that's used to numb one part of your body. You usually get local anaesthetics as injections.

## **CT scan**

A CT scan is a type of X-ray. It takes several detailed pictures of the inside of your body from different angles. CT stands for computed tomography. It is also called a CAT scan (computed axial tomography).

## **electrode**

A wire or disc through which electric current passes.

## **seizure**

A seizure (or fit) is when there is too much electrical activity in your brain, which results in muscle twitching and other symptoms.

## **haemorrhage**

Haemorrhage is a word doctors use for bleeding. Any time blood escapes from a vessel, it's called a haemorrhage.

## **general anaesthetic**

You may have a type of medicine called a general anaesthetic when you have surgery. It is given to make you unconscious so you don't feel pain when you have surgery.

## **bacteria**

Bacteria are tiny organisms. There are lots of different types. Some are harmful and can cause disease. But some bacteria live in your body without causing any harm.

## **pneumonia**

Pneumonia is an infection in your lungs. Anything that causes infections (bacteria, viruses or fungi, for example) can give you pneumonia.

## **schizophrenia**

Schizophrenia is a mental illness that causes delusions and hallucinations.

## **glaucoma**

Glaucoma is a condition that affects the eyes. If you have glaucoma, your vision slowly gets worse. It happens when certain nerves in your head get damaged. These nerves carry images of what you see to your brain. Glaucoma is often caused by high pressure inside your eye.

## **Sources for the information on this leaflet:**

1. Pearce JM. Parkinson's disease and its management. Oxford Medical, London, UK; 1992.
2. Goldsmith C. Parkinson's disease. American Journal of Nursing. 1999; 99: 46-47.
3. Ben-Shlomo Y. How far are we in understanding the cause of Parkinson's disease? Journal of Neurology, Neurosurgery and Psychiatry. 1996; 61: 4-16.

## Parkinson's disease

4. de Rijk MC, Tzourio C, Breteler MM, et al. Prevalence of Parkinsonism and Parkinson's disease in Europe: the EUROPARKINSON Collaborative Study. *Journal of Neurology, Neurosurgery and Psychiatry*. 1997; 62: 10-15.
5. Marder K, Tang MX, Mejia H, et al. Risk of Parkinson's disease among first-degree relatives: a community-based study. *Neurology*. 1996; 47: 155-160.
6. Jarman P, Wood N. Parkinson's disease genetics comes of age. *BMJ*. 1999; 318: 1641-1642.
7. Lazzarini AM, Myers RH, Zimmerman TR Jr, et al. A clinical genetic study of Parkinson's disease: evidence for dominant transmission. *Neurology*. 1994; 44: 499-506.
8. National Institute of Neurological Disorders and Stroke. Parkinson's disease: hope through research. March 2014. Available at [http://www.ninds.nih.gov/disorders/parkinsons\\_disease/detail\\_parkinsons\\_disease.htm](http://www.ninds.nih.gov/disorders/parkinsons_disease/detail_parkinsons_disease.htm) (accessed on 3 March 2014).
9. Parkinson's UK. What is Parkinson's? Available at [http://www.parkinsons.org.uk/about\\_parkinsons/what\\_is\\_parkinsons.aspx](http://www.parkinsons.org.uk/about_parkinsons/what_is_parkinsons.aspx) (accessed on 3 March 2014).
10. Parkinson's UK. About Parkinson's. Available at [http://www.parkinsons.org.uk/about\\_parkinsons.aspx](http://www.parkinsons.org.uk/about_parkinsons.aspx) (accessed on 3 March 2014).
11. Backer JH. Stressors, social support, coping, and health dysfunction in individuals with Parkinson's disease. *Journal of Gerontological Nursing*. 2000; 26: 6-16.
12. Habermann B. Day-to-day demands of Parkinson's disease. *Western Journal of Nursing Research*. 1996; 18: 397-413.
13. Stacy M. Sleep disorders in Parkinson's disease: epidemiology and management. *Drugs and Aging*. 2002; 19: 733-739.
14. Grossman M, Zurif E, Lee C, et al. Information processing speed and sentence comprehension in Parkinson's disease. *Neuropsychology*. 2002; 16: 174-181.
15. O'Reilly F, Finnan F, Allwright S, et al. The effects of caring for a spouse with Parkinson's disease on social, psychological and physical well-being. *British Journal of General Practice*. 1996; 46: 507-512.
16. Parkinson's UK. Everyday life with Parkinson's. Available at <http://www.parkinsons.org.uk/content/everyday-life-parkinsons> (accessed on 3 March 2014).
17. Reuter I, Engelhardt M, Stecker K, et al. Therapeutic value of exercise training in Parkinson's disease. *Medicine and Science in Sports and Exercise*. 1999; 31: 1544-1549.
18. Parkinson's UK. Drug treatments. Available at <http://www.parkinsons.org.uk/content/drug-treatments> (accessed on 3 March 2014).
19. Luquin MR, Scipioni O, Vaamonde J, et al. Levodopa-induced dyskinesias in Parkinson's disease: clinical and pharmacological classification. *Movement Disorders*. 1992; 7: 117-124.
20. Poewe WH, Lees AJ, Stern GM. Dystonia in Parkinson's disease: clinical and pharmacological features. *Annals of Neurology*. 1988; 23: 73-78.
21. Munchau A, Bhatia KP. Pharmacological treatment of Parkinson's disease. *Postgraduate Medical Journal*. 2000; 76: 602-610.
22. Dupont E, Andersen A, Boas J, et al. Sustained-release Madopar HBS compared with standard Madopar in the long-term treatment of de novo Parkinsonian patients. *Acta Neurologica Scandinavica*. 1996; 93: 14-20.
23. Block G, Liss C, Reines S, et al. Comparison of immediate-release and controlled release carbidopa/levodopa in Parkinson's disease: a multicenter 5-year study. *European Neurology*. 1997; 37: 23-27.
24. van Hilten JJ, Ramaker CC, Stowe R, et al. Bromocriptine/levodopa combined versus levodopa alone for early Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
25. Rascol O, Brooks DJ, Korczyn AD, et al. A five-year study of the incidence of dyskinesia in patients with early Parkinson's disease who were treated with ropinirole or levodopa. *New England Journal of Medicine*. 2002; 342: 1484-1491.

## Parkinson's disease

26. Parkinson Study Group. Pramipexole vs levodopa as initial treatment for Parkinson disease: a randomized controlled trial. *Journal of the American Medical Association*. 2000; 284: 1931-1938.
27. Rinne U. A 5-year double-blind study with cabergoline versus levodopa in the treatment of early Parkinson's disease. *Parkinsonism and Related Disorders*. 1999; 5 (supplement): S84.
28. Oertel WH. Pergolide versus levodopa monotherapy (PELMOPET). *Movement Disorders*. 2000; 15 (supplement 3): S4.
29. Rinne UK. Lisuride, a dopamine agonist in the treatment of early Parkinson's disease. *Neurology*. 1989; 39: 336-339.
30. Allain H, Destee A, Petit H, et al. Five-year follow-up of early lisuride and levodopa combination therapy versus levodopa monotherapy in de novo Parkinson's disease. *European Neurology*. 2000; 44: 22-30.
31. National Institute for Health and Care Excellence. Parkinson's disease: diagnosis and management in primary and secondary care. June 2006. Clinical guideline 35. Available at <http://www.nice.org.uk/CG035> (accessed on 3 March 2014).
32. Lang AE, Lozano AM. Parkinson's disease. *New England Journal of Medicine*. 1998; 339: 1044-1053.
33. Langston JW, Widner H, Goetz CG, et al. Core assessment program for intracerebral transplantations (CAPIT). *Movement Disorders*. 1992; 7: 2-13.
34. Parkinson's UK. Diagnosing Parkinson's information sheet. Available at <http://www.parkinsons.org.uk/content/diagnosing-parkinsons-information-sheet> (accessed 3 March 2014).
35. Marjama-Lyons JM, Koller WC. Parkinson's disease: update in diagnosis and symptom management. *Geriatrics*. 2001; 56: 24-25.
36. Parkinson's UK. About Parkinson's. Available at [http://www.parkinsons.org.uk/about\\_parkinsons.aspx](http://www.parkinsons.org.uk/about_parkinsons.aspx) (accessed on 3 March 2014).
37. National Institute for Health and Care Excellence. Parkinson's disease: diagnosis and management in primary and secondary care. June 2006. Clinical guideline 35. Available at <http://www.nice.org.uk/CG035> (accessed on 3 March 2014).
38. Fahn S, Oakes D, Shoulson I, et al. Levodopa and the progression of Parkinson's disease. *New England Journal of Medicine*. 2004; 351: 2498-2508.
39. Rajput A, Utti J, Offord K. Timely levodopa (LD) administration prolongs survival in Parkinson's disease. *Parkinsonism and Related Disorders*. 1997; 3: 149-165.
40. Marsden CD, Parkes JD, Quinn N. Movement disorders. In: Marsden CD, Fahn S (editors). *Movement disorders*. Butterworths Scientific, London, UK; 1982.
41. Clarke CE, Speller JM. Lisuride versus bromocriptine for levodopa-induced complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
42. British National Formulary. Dopaminergic drugs used in Parkinson's disease. Section 4.9.1. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://www.bnf.org> (accessed on 3 March 2014).
43. Medicines and Healthcare Products Regulatory Agency. Public assessment report: dopamine agonists: pathological gambling and increased libido. August 2007. Available at <http://www.mhra.gov.uk/Safetyinformation/DrugSafetyUpdate/CON079100> (accessed on 3 March 2014).
44. Fahn S, Oakes D, Shoulson I, et al. Levodopa and the progression of Parkinson's disease. *New England Journal of Medicine*. 2004; 351: 2498-2508.
45. Jarman B, Hurwitz B, Cook A, et al. Effects of community based nurses specialising in Parkinson's disease on health outcome and costs: randomised controlled trial. *BMJ*. 2002; 324: 1072-1075.
46. Jahanshahi M, Brown RG, Whitehouse C, et al. Contact with a nurse practitioner: a short-term evaluation study in Parkinson's disease and dystonia. *Behavioural Neurology*. 1994; 7: 189-196.

## Parkinson's disease

47. Jarman B, Hurwitz B, Cook A, et al. Effects of community based nurses specialising in Parkinson's disease on health outcome and costs: randomised controlled trial. *BMJ*. 2002; 324: 1072-1075.
48. Clarke CE, Moore AP. Parkinson's disease. August 2007. *Clinical Evidence*. (Based on November 2006 search.) Available at <http://clinicalevidence.bmj.com/x/systematic-review/1203/overview.html> (accessed on 3 March 2014).
49. Thomas A, Iacono D, Luciano AL, et al. Duration of amantadine benefit on dyskinesia of severe Parkinson's disease. *Journal of Neurology, Neurosurgery and Psychiatry*. 2004; 75: 141-143.
50. da Silva-Junior FP, Braga-Neto P, Sueli Monte F, et al. Amantadine reduces the duration of levodopa-induced dyskinesia: a randomized, double-blind, placebo-controlled study. *Parkinsonism and Related Disorders*. 2005; 11: 449-452.
51. National Institute for Health and Care Excellence. Parkinson's disease: guideline for diagnosis and management in primary and secondary care. June 2006. Clinical guideline 35. Available at <http://www.nice.org.uk/CG035> (accessed on 3 March 2014).
52. Lees AJ. Drugs for Parkinson's disease. *Journal of Neurology, Neurosurgery and Psychiatry*. 2002; 73: 607-610.
53. British National Formulary. Amantadine hydrochloride. Section 4.9.1. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://bnf.org> (accessed on 3 March 2014).
54. Wessel K, Szelényi I. Selegiline: an overview of its role in the treatment of Parkinson's disease. *Clinical Investigator*. 1992; 70: 459-462.
55. Ives NJ, Stowe RL, Marro J, et al. Monoamine oxidase type B inhibitors in early Parkinson's disease: meta-analysis of 17 randomised trials involving 3525 patients. *BMJ*. 2004; 329: 593-599.
56. Stern MB, Marek KL, Friedman J, et al. Double-blind, randomized, controlled trial of rasagiline as monotherapy in early Parkinson's disease patients. *Movement Disorders*. 2004; 19: 916-923.
57. The Italian Parkinson Study Group. A multicenter Italian randomised study on early treatment of Parkinson disease: comparison of L-dopa, L-deprenyl and dopaminergic agonists: study design and short term results. *Italian Journal of Neurological Science*. 1992; 13: 735-739 [in Italian].
58. Stowe R, Ives N, Clarke CE, et al. Evaluation of the efficacy and safety of adjuvant treatment to levodopa therapy in Parkinson's disease patients with motor complications (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
59. Palhagen S, Heinonen EH, Hagglund J, et al. Selegiline delays the onset of disability in de novo parkinsonian patients: Swedish Parkinson Study Group. *Neurology*. 1998; 51: 520-525.
60. Rutledge CO, Sonsalla PK. Drugs used in Parkinsonism. In: Craig CR, Stitzel RE (editors). *Modern pharmacology with clinical applications*. 5th Edition. Little, Brown, Boston, MA; 1997.
61. Ives NJ, Stowe RL, Marro J, et al. Monoamine oxidase type B inhibitors in early Parkinson's disease: meta-analysis of 17 randomised trials involving 3525 patients. *BMJ*. 2004; 329: 593-599.
62. Brooks DJ. Dopamine agonists: their role in the treatment of Parkinson's disease. *Journal of Neurology, Neurosurgery and Psychiatry*. 2000; 68: 685-689.
63. National Institute for Health and Care Excellence. Parkinson's disease: guideline for diagnosis and management in primary and secondary care. June 2006. Clinical guideline 35. Available at <http://www.nice.org.uk/CG035> (accessed on 3 March 2014).
64. Stowe R, Ives N, Clarke CE, et al. Dopamine agonist therapy in early Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
65. Katzenschlager R, Head J, Schrag A, et al. Fourteen-year final report of the randomized PDRG-UK trial comparing three initial treatments in PD. *Neurology*. 2008; 71: 474-80.
66. British National Formulary. Rotigotine. Section 4.9.1. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://bnf.org> (accessed on 3 March 2014).

## Parkinson's disease

67. Chaudhuri KR, Pal S, Brefel-Courbon C. 'Sleep attacks' or 'unintended sleep episodes' occur with dopamine agonists: is this a class effect? *Drug Safety*. 2002; 25: 473-483.
68. British National Formulary. Dopamine receptor agonists. Section 4.9.1. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://bnf.org> (accessed on 3 March 2014).
69. Medicines and Healthcare Products Regulatory Agency. Public assessment report: dopamine agonists: pathological gambling and increased libido. August 2007. Available at <http://www.mhra.gov.uk/Safetyinformation/DrugSafetyUpdate/CON079100> (accessed on 3 March 2014).
70. Watts RL, Jankovic J, Waters C, et al. Randomized, blind, controlled trial of transdermal rotigotine in early Parkinson disease. *Neurology*. 2007; 68: 272-276.
71. Jankovic J, Watts RL, Martin W, et al. Transdermal rotigotine: double-blind, placebo-controlled trial in Parkinson disease. *Archives of Neurology*. 2007; 64: 676-82.
72. Rascol O, Brooks DJ, Korczyn AD, et al. A five-year study of the incidence of dyskinesia in patients with early Parkinson's disease who were treated with ropinirole or levodopa. *New England Journal of Medicine*. 2002; 342: 1484-1491.
73. Parkinson Study Group. Pramipexole vs levodopa as initial treatment for Parkinson disease: a randomized controlled trial. *Journal of the American Medical Association*. 2000; 284: 1931-1938.
74. British National Formulary. Bromocriptine and other dopaminergic drugs. Section 6.7.1. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://bnf.org> (accessed on 3 March 2014).
75. British National Formulary. Dopamine receptor agonists. Section 4.9.1. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://bnf.org> (accessed on 3 March 2014).
76. Tuite P, Ebbitt B. Dopamine agonists. *Seminars in Neurology*. 2001; 21: 9-14.
77. Clarke CE, Speller JM. Pergolide for levodopa-induced complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
78. Talati R, Baker WL, Patel AA, et al. Adding a dopamine agonist to preexisting levodopa therapy vs. levodopa therapy alone in advanced Parkinson's disease: a meta analysis. *International Journal of Clinical Practice*. 2009; 63: 613-623.
79. Clarke CE, Deane KH. Cabergoline for levodopa-induced complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
80. Clarke CE, Deane KH. Ropinirole for levodopa-induced complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
81. Clarke CE, Speller JM, Clarke JA. Pramipexole for levodopa-induced complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
82. van Hilten JJ, Ramaker CC, Stowe R, et al. Bromocriptine/levodopa combined versus levodopa alone for early Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
83. van Hilten JJ, Ramaker C, Van de Beek WJ, et al. Bromocriptine for levodopa-induced motor complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
84. Clarke CE, Speller JM. Lisuride for levodopa-induced complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
85. Clarke C, Speller J. Pergolide versus bromocriptine for levodopa-induced motor complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
86. Clarke CE, Speller JM, Clarke JA. Pramipexole versus bromocriptine for levodopa-induced complications in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.

## Parkinson's disease

87. Clarke CE, Deane KH. Ropinirole versus bromocriptine for levodopa-induced complications in Parkinson's disease (Cochrane review). In: The Cochrane Library. Wiley, Chichester, UK.
88. Clarke CE, Deane KD. Cabergoline versus bromocriptine for levodopa-induced complications in Parkinson's disease (Cochrane review). In: The Cochrane Library. Wiley, Chichester, UK.
89. Mizuno Y, Yanagisawa N, Kuno S, et al. Japanese Pramipexole Study Group: randomized, double-blind study of pramipexole with placebo and bromocriptine in advanced Parkinson's disease. *Movement Disorders*. 2003; 18: 1149-1156.
90. Zhang Z-X, Li H, Luo Y, et al. A multicentre, randomised, double-blind, placebo-controlled clinical study on entacapone for the treatment of Parkinson's disease. *Chinese Journal of Neurology*. 2003; 36: 406-410.
91. Rascol O, Brooks DJ, Melamed E, et al. Rasagiline as an adjunct to levodopa in patients with Parkinson's disease and motor fluctuations (LARGO, lasting effect in adjunct therapy with rasagiline given once daily, study): a randomised, double-blind, parallel-group trial. *Lancet*. 2005; 365: 947-954.
92. Deane KHO, Spieker S, Clarke CE. Catechol-O-methyltransferase inhibitors for levodopa-induced complications in Parkinson's disease (Cochrane review). In: The Cochrane Library. Wiley, Chichester, UK.
93. Munchau A, Bhatia KP. Pharmacological treatment of Parkinson's disease. *Postgraduate Medical Journal*. 2000; 76: 602-610.
94. Valeant Pharmaceuticals International. About Tasmar: labeling update. Available at <http://tasmar.com/about-tasmar/labeling-update> (accessed on 3 March 2014).
95. U.S. Food and Drug Administration. FDA drug safety communication: ongoing safety review of Stalevo (entacapone/carbidopa/levodopa) and possible development of prostate cancer. Available at <http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm206363.htm> (accessed on 3 March 2014).
96. Deane KHO, Spieker S, Clarke CE. Catechol-O-methyltransferase inhibitors for levodopa-induced complications in Parkinson's disease (Cochrane review). In: The Cochrane Library. Wiley, Chichester, UK.
97. Zhang Z-X, Li H, Luo Y, et al. A multicentre, randomised, double-blind, placebo-controlled clinical study on entacapone for the treatment of Parkinson's disease. *Chinese Journal of Neurology*. 2003; 36: 406-410.
98. Rascol O, Brooks DJ, Melamed E, et al. Rasagiline as an adjunct to levodopa in patients with Parkinson's disease and motor fluctuations (LARGO, lasting effect in adjunct therapy with rasagiline given once daily, study): a randomised, double-blind, parallel-group trial. *Lancet*. 2005; 365: 947-954.
99. Uitti RJ. Surgical treatments for Parkinson's disease. *Canadian Family Physician*. 2000; 46: 368-373.
100. Eskander EM, Cosgrove GR, Shinobu LA. Surgical treatment of Parkinson disease. *Journal of the American Medical Association*. 2001; 286: 3056.
101. Bronstein JM, DeSalles A, DeLong MR. Stereotactic pallidotomy in the treatment of Parkinson disease: an expert opinion. *Archives of Neurology*. 1999; 56: 1064-1069.
102. Development and Evaluation Committee. Report 105. Pallidotomy, thalotomy and deep brain stimulation for severe Parkinson's disease. Wessex Institute for Health Research and Development, Southampton, UK; 1999.
103. Goetz CG, Poewe W, Rascol O, et al. Evidence-based medical review update: pharmacological and surgical treatments of Parkinson's disease. *Movement Disorders*. 2005; 20: 523-539.
104. Vitek JL, Bakay RA, Freeman A, et al. Randomized trial of pallidotomy versus medical therapy for Parkinson's disease. *Annals of Neurology*. 2003; 53: 558-569.
105. de Bie RM, de Haan RJ, Nijssen PC, et al. Unilateral pallidotomy in Parkinson's disease: a randomised, single-blind, multicentre trial. *Lancet*. 1999; 354: 1665-1669.



## Parkinson's disease

106. National Institute for Health and Care Excellence. Deep brain stimulation for Parkinson's disease. November 2003. Interventional procedure guidance 19. Available at <http://www.nice.org.uk/ipg019> (accessed on 3 March 2014).
107. Merello M, Nouzeilles MI, Kuzis G, et al. Unilateral radiofrequency lesion versus electrostimulation of posteroventral pallidum: a prospective randomized comparison. *Movement Disorders*. 1999; 14: 50-56.
108. Esselink R, Bie de R, de Haan R, et al. Unilateral pallidotomy versus bilateral subthalamic nucleus stimulation in PD: a randomized trial. *Neurology*. 2004; 62: 201-207.
109. Crabb L. Parkinson's disease: neurosurgical procedures. *Elderly Care*. 1999; 11: 35-38.
110. Gregory R. Posteroventral pallidotomy for advanced Parkinson's disease: a systematic review. *Neurology Review International*. 1999; 3: 8-12.
111. Green J, McDonald WM, Vitek JL, et al. Neuropsychological and psychiatric sequelae of pallidotomy for PD. *Neurology*. 2002; 58: 858-865.
112. Schmand B, de Bie RM, Koning-Haanstra M, et al. Unilateral pallidotomy in PD: a controlled study of cognitive and behavioral effects. *Neurology*. 2000; 54: 1058-1064.
113. Goetz CG, Poewe W, Rascol O, et al. Evidence-based medical review update: pharmacological and surgical treatments of Parkinson's disease. *Movement Disorders*. 2005; 20: 523-539.
114. Medical Services Advisory Committee. Deep brain stimulation for Parkinson's disease. Australian Department of Health and Ageing, Canberra, Australia; 2001.
115. Weaver FM, Follett K, Stern M, et al. Bilateral deep brain stimulation vs best medical therapy for patients with advanced Parkinson disease: a randomized controlled trial. *Journal of the American Medical Association*. 2009; 301: 63-73.
116. Williams A, Gill S, Varma T, et al. Deep brain stimulation plus best medical therapy versus best medical therapy alone for advanced Parkinson's disease (PD SURG trial): a randomised, open-label trial. *Lancet Neurology*. 2010; 9: 581-591.
117. Goetz CG, Poewe W, Rascol O, et al. Evidence-based medical review update: pharmacological and surgical treatments of Parkinson's disease. *Movement Disorders*. 2005; 20: 523-539.
118. Marks W, Chadwick W, Ostrem J, et al. A prospective, randomized trial of globus pallidus vs. subthalamic nucleus deep brain stimulation for Parkinson's disease. *Movement Disorders*. 2004; 19 (supplement 1): S318-S319.
119. Anderson VC, Burchiel KJ, Hogarth P, et al. Pallidal vs subthalamic nucleus deep brain stimulation in Parkinson's disease. *Archives of Neurology*. 2005; 62: 554-560.
120. Follett KA, Weaver FM, Stern M, et al. Pallidal versus subthalamic deep-brain stimulation for Parkinson's disease. *New England Journal of Medicine*. 2010; 362: 2077-2091.
121. Anderson VC, Burchiel KJ, Hogarth P, et al. Pallidal vs subthalamic nucleus deep brain stimulation in Parkinson's disease. *Archives of Neurology*. 2005; 62: 554-560.
122. Marks W, Chadwick W, Ostrem J, et al. A prospective, randomized trial of globus pallidus vs. subthalamic nucleus deep brain stimulation for Parkinson's disease. *Movement Disorders*. 2004; 19 (supplement 1): S318-S319.
123. Medical Services Advisory Committee. Deep brain stimulation for Parkinson's disease. Australian Department of Health and Ageing, Canberra, Australia; 2001.
124. Deuschl G, Schade-Brittinger C, Krack P, et al. A randomized trial of deep-brain stimulation for Parkinson's disease. *New England Journal of Medicine*. 2006; 355: 896-908.
125. Marks W, Chadwick W, Ostrem J, et al. A prospective, randomized trial of globus pallidus vs. subthalamic nucleus deep brain stimulation for Parkinson's disease. *Movement Disorders*. 2004; 19: 318-319.

## Parkinson's disease

126. Okun MS, Gallo BV, Mandybur G, et al. Subthalamic deep brain stimulation with a constant-current device in Parkinson's disease: an open-label randomised controlled trial. *Lancet Neurology*. 2012; 11: 140-149.
127. Crosby N, Deane KH, Clarke CE, et al. Amantadine in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
128. Schuurman PR, Bosch DA, Bossuyt PM, et al. A comparison of continuous thalamic stimulation and thalamotomy for suppression of severe tremor. *New England Journal of Medicine*. 2000; 342: 461-468.
129. Hallett M, Litvan I. Evaluation of surgery for Parkinson's disease: a report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology*. 1999; 53: 1910-1921.
130. Obeso JA, Rodriguez MC, Gorospe A, et al. Surgical treatment of Parkinson's disease. *Bailliere's Clinical Neurology*. 1997; 6: 125-145.
131. PD SURG. PD SURG trials. Available at <http://www.pdsurg.bham.ac.uk> (accessed on 3 March 2014).
132. de Goede CJ, Keus SH, Kwakkel G, et al. The effects of physical therapy in Parkinson's disease: a research synthesis. *Archives of Physical Medicine and Rehabilitation*. 2001; 82: 509-515.
133. Parkinson's UK. Therapies and Parkinson's management: physiotherapy. Available at <http://www.parkinsons.org.uk/content/physiotherapy> (accessed on 3 March 2014).
134. National Institute for Health and Care Excellence. Parkinson's disease: diagnosis and management in primary and secondary care. June 2006. Clinical guideline 35. Available at <http://www.nice.org.uk/CG035> (accessed on 3 March 2014).
135. Tomlinson CL, Patel S, Meek C, et al. Physiotherapy versus placebo or no intervention in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
136. Mehrholz J, Friis R, Kugler J, et al. Treadmill training for patients with Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
137. Lima LO, Scianni A, Rodrigues-de-Paula F. Progressive resistance exercise improves strength and physical performance in people with mild to moderate Parkinson's disease: a systematic review. *Journal of Physiotherapy*. 2013; 59: 7-13.
138. Deane KH, Jones D, Playford ED, et al. Physiotherapy for patients with Parkinson's disease: a comparison of techniques (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
139. Deane KH, Ellis-Hill C, Playford ED, et al. Occupational therapy for Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
140. National Institute for Health and Care Excellence. Parkinson's disease: diagnosis and management in primary and secondary care. June 2006. Clinical guideline 35. Available at <http://www.nice.org.uk/CG035> (accessed on 3 March 2014).
141. Parkinson's UK. Everyday life with Parkinson's. Available at <http://www.parkinsons.org.uk/content/everyday-life-parkinsons> (accessed on 3 March 2014).
142. Parkinson's UK. Therapies and Parkinson's management. Available at <http://www.parkinsons.org.uk/about-parkinsons/treating-parkinsons/therapies.aspx> (accessed on 3 March 2014).
143. National Institute for Health and Care Excellence. Parkinson's disease: diagnosis and management in primary and secondary care. June 2006. Clinical guideline 35. Available at <http://www.nice.org.uk/CG035> (accessed on 3 March 2014).
144. Herd CP, Tomlinson CL, Deane KH, et al. Speech and language therapy versus placebo or no intervention for dysarthria in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
145. Herd CP, Tomlinson CL, Deane KH, et al. Comparison of speech and language therapy techniques for speech problems in Parkinson's disease (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.

## Parkinson's disease

146. Parkinson's UK. Eating, swallowing and saliva control in Parkinson's information sheet. <http://www.parkinsons.org.uk/content/eating-swallowing-and-saliva-control-parkinsons-information-sheet> (accessed on 3 March 2014).
147. Deane KHO, Whurr R, Clarke CE, et al. Non-pharmacological therapies for dysphagia in Parkinson's disease (Cochrane review). In: The Cochrane Library. Wiley, Chichester, UK.
148. Horn S, Stern MB. The comparative effects of medical therapies for Parkinson's disease. *Neurology*. 2004; 63 (supplement 2): S7-S12.
149. Parkinson's UK. Surgery. Available at <http://www.parkinsons.org.uk/about-parkinsons/treating-parkinsons/surgery.aspx> (accessed on 3 March 2014).

---

This information is aimed at a UK patient audience. This information however does not replace medical advice. If you have a medical problem please see your doctor. Please see our full [Conditions of Use](#) for this content. For more information about this condition and sources of the information contained in this leaflet please visit the Best Health website, <http://besthealth.bmj.com>. These leaflets are reviewed annually.

