TEST

Intravenous pyelogram

An intravenous pyelogram uses injected contrast and x-rays to examine the kidneys, ureters, and bladder.

WHAT IT MEASURES
How contrast travels through the kidneys, ureters, and bladder

SAMPLE
None; x-ray imaging with injected contrast

FASTING NEEDED?
Sometimes, according to the imaging centre's instructions

HOW LONG IT TAKES
Usually 30 to 60 minutes

RESULTS IN
Same day to several days; varies by radiology service

USED FOR
Diagnosing urinary tract blockage, stones, and structural problems

MAIN LIMITATION
Reduced kidney function may prevent clear contrast filling

Overview

An intravenous pyelogram, or IVP, is an x-ray examination of your urinary tract. The urinary tract includes the kidneys, the tubes carrying urine to the bladder called ureters, and the bladder itself.

During the test, an iodine-containing contrast liquid is injected into a vein. Your kidneys remove the contrast from your blood and pass it into your urine. A series of x-rays then shows how the contrast moves through your urinary tract.

An IVP can reveal a blockage, an unusual shape, swelling of the urine-collecting system, and some kidney or ureter stones. It may also help investigate blood in the urine.

CT, ultrasound, and MRI have replaced IVP for many purposes because they can provide more detail or avoid some of its limitations. However, IVP is still used in selected situations and may be available where other imaging is unsuitable or unavailable.

Why the test is ordered

An IVP may be ordered to look for a physical problem affecting the flow of urine. Possible reasons include:

The test may show that one kidney is releasing contrast more slowly than the other. It can also show widening above a blockage or a gap where contrast does not fill the urinary tract normally.

These findings do not always identify the exact cause. Another imaging test or a procedure that looks inside the bladder may be needed.

- Blood in the urine
- Suspected kidney or ureter stones
- A possible blockage or narrowing
- Repeated urinary tract infections
- An unusual urinary tract structure
- Follow-up after certain urinary tract procedures

Who should have the test

Whether IVP is appropriate depends on your symptoms, medical history, previous imaging, and the clinical question being investigated. For many adults with suspected stones or blood in the urine, CT or ultrasound may now be preferred.

Tell the imaging team before the test if you:

A shellfish allergy does not by itself mean that you are allergic to iodine-containing contrast. A previous reaction to the same type of contrast is more relevant. The imaging team will assess the type and severity of any earlier reaction.

During pregnancy, imaging that does not use radiation, such as ultrasound, is generally considered first when it can answer the clinical question. If imaging is urgent, the benefits and risks are assessed for your situation.

- Are or could be pregnant
- Have reduced kidney function or kidney disease
- Previously reacted to injected x-ray contrast
- Have diabetes

- Take metformin, water tablets like furosemide or hydrochlorothiazide , or other regular medicines
- Have recently had another contrast examination
- Are unable to lie still or change position

How to prepare

Follow the instructions from your imaging centre because preparation is not the same everywhere. You may be asked not to eat for several hours before the appointment. Clear fluids may still be permitted, but confirm this with the centre.

Some services may ask you to use a laxative or follow a limited diet so that stool and bowel gas do not hide the urinary tract. Do not take bowel preparation unless you have been instructed to do so.

You may need a recent blood test to check kidney function. This is more likely if you have kidney disease, diabetes, dehydration, or other factors that could affect your kidneys.

Bring an up-to-date medicines list. Do not stop metformin or any other prescribed medicine on your own. Whether metformin needs to be paused depends mainly on kidney function, the type of contrast procedure, and local policy.

Remove clothing or objects containing metal from the area being examined. You may be asked to change into a gown.

What happens during the test

You will usually lie on an x-ray table. An initial x-ray may be taken before the contrast is given. This can show some stones and help the radiologist plan the examination.

A small plastic tube called a cannula is placed into a vein, usually in your arm or hand. Contrast is injected through it. You may briefly feel warm, have a metallic taste, or feel as though you are passing urine. These sensations usually settle quickly.

X-rays are taken at set times as your kidneys filter the contrast. The radiographer may ask you to hold your breath, turn slightly, or change position. A compression band may sometimes be placed across the lower abdomen to help fill the kidney drainage systems. It should not be used when compression would be unsafe.

You may be asked to empty your bladder before a final image. The examination commonly takes 30 to 60 minutes, but delayed images can make it longer if contrast passes slowly.

Understanding your results

A radiologist examines the images and sends a report to the healthcare professional who requested the test.

The report may describe:

A delayed or poorly seen kidney does not prove that it has permanently lost function. It may reflect reduced kidney function, dehydration, obstruction, or the timing and quality of the images.

A "filling defect" means that contrast has not filled part of the urinary tract as expected. Possible explanations include a stone, blood clot, tissue growth, normal anatomy, or an imaging artefact. Further testing may be needed to tell these apart.

There is no universal numerical reference range for an IVP. Although this is not a laboratory test, interpretation can vary with the imaging protocol, age, sex, pregnancy status, medicines, kidney function, and clinical context.

- Whether both kidneys take up and release contrast
- The size, shape, and position of the kidneys
- Whether the ureters fill normally
- Areas of narrowing, widening, blockage, or delayed drainage
- Stones that are visible on x-ray
- The shape and emptying of the bladder

What affects the results

The images depend on your kidneys filtering enough contrast and on the urinary tract being clearly visible. Results can be unclear even when the equipment and procedure worked correctly.

Important influences include:

The timing of each image matters. If the pictures are taken before or after the most useful moment, part of the urinary tract may not be fully outlined. Additional delayed images can sometimes resolve this.

- Reduced kidney function: Less contrast may enter the urine, producing faint or delayed images.

- Dehydration: This can change urine flow and slow contrast passage.
- A severe blockage: Contrast may not pass beyond the obstructed area.
- Bowel gas or stool: These can cover parts of the kidneys or ureters on x-ray.
- Movement: Breathing or moving during an exposure can blur an image.
- Body size: More tissue can reduce x-ray detail.
- Recent contrast: Contrast remaining from another examination can complicate interpretation.
- Medicines affecting urine flow: Diuretics, sometimes called water tablets, may change how quickly the urinary tract fills.

Accuracy and limitations

IVP can show the general outline of the urinary tract and whether contrast drains through it. It may identify an obstruction or some stones, but it cannot reliably show every cause.

Small stones, small tumours, subtle lining abnormalities, and problems outside the urinary tract may be missed. A kidney with poor function may not release enough contrast to reveal an abnormality. Overlying bowel contents can also hide findings.

The test can also suggest a problem when none is present. Normal folds, pressure from nearby structures, a blood clot, or incomplete filling can resemble narrowing or a mass.

CT urography usually provides more detailed views when investigating the urinary tract. A non-contrast CT is often better for detecting stones. Ultrasound can assess kidney swelling without radiation or iodine-containing contrast. MRI may be useful in selected situations. Cystoscopy, which uses a small camera to examine the bladder, is better for directly assessing the bladder lining.

Risks and complications

IVP uses ionising radiation. The amount is kept as low as reasonably possible, but the test is avoided when another suitable method can provide the needed information without radiation.

The contrast injection may cause a brief warm feeling, nausea, itching, or a mild rash. Serious allergic-like reactions can occur but are uncommon. Tell staff immediately if you develop breathing difficulty, throat tightness, facial swelling, widespread hives, or feel faint.

Contrast can leak from the vein into nearby tissue. This usually causes temporary pain or

swelling. Tell staff promptly if the injection site becomes painful, tight, or swollen.

A significant kidney problem after modern intravenous contrast is unusual for most people, but risk is higher when kidney function is severely reduced or during acute kidney injury. This is why kidney function and hydration may be assessed beforehand.

After leaving, call emergency services for breathing difficulty, collapse, or swelling of the face or throat. Seek urgent advice for severe or increasing injection-site pain, blistering, marked swelling, or a serious delayed skin reaction. A mild rash without breathing or facial symptoms can usually be discussed promptly with your healthcare team.

What happens next

You can usually return to normal activities after the examination. If fluids are not restricted for another medical reason, you may be encouraged to drink normally afterward.

The requesting healthcare professional will review the report alongside your symptoms, examination, urine tests, blood tests, and any previous scans. A routine follow-up appointment may be enough when the findings are normal or non-urgent.

If the IVP is unclear or shows a possible abnormality, the next step might be ultrasound, CT, MRI, cystoscopy, or referral to a urinary tract specialist. The choice depends on what the IVP showed and why it was requested.

Do not wait for a routine result appointment if you develop severe flank pain with fever, cannot pass urine, become confused or very unwell, or have heavy visible bleeding in the urine. Seek urgent medical assessment.

Common questions

Can I drink coffee before an IVP?

Only if your preparation instructions allow it. Some centres permit clear fluids but exclude milk. Coffee can also increase urine production, so follow the specific instructions you received.

Does the time of day matter?

Usually not. Appointment timing mainly affects how long you need to fast and when any bowel preparation is taken.

Can I exercise beforehand?

Light normal activity is unlikely to affect the examination. Avoid arriving dehydrated after strenuous exercise, especially if you have been told not to drink.

Can I drive home afterward?

Most people can drive after a routine IVP. Arrange help if you receive a sedating medicine, have a contrast reaction, or feel unwell.

Will the contrast make my urine change colour?

Usually not. The contrast is generally colourless when dissolved in urine, although you may urinate more often if you have been drinking extra fluid.

Is an IVP the same as a CT scan?

No. An IVP uses a series of standard x-rays after contrast injection. CT creates cross-sectional images and usually shows more anatomical detail.

Sources

- RadiologyInfo.org: Intravenous Pyelogram - patient information from the American College of Radiology and Radiological Society of North America
- American College of Radiology: ACR Manual on Contrast Media - guidance on contrast reactions, kidney considerations, metformin, pregnancy, and contrast leakage
- Davenport MS, Perazella MA, Yee J, et al. Use of Intravenous Iodinated Contrast Media in Patients With Kidney Disease: Consensus Statements From the ACR and National Kidney Foundation - Radiology , 2020
- American College of Radiology: ACR Appropriateness Criteria-Hematuria - comparison of imaging options for blood in the urine
- National Institute for Health and Care Excellence: Renal and ureteric stones-assessment and management - guidance on imaging for suspected urinary stones