Intravenous pyelography (IVP)

Introduction
- In the past, IVP constituted one of the basic diagnostic techniques in Urology because it provides functional and morphological information on the urinary tract.
- Currently, it is being replaced by other techniques such as uro-CT or uro-MRI, although it is still useful in diagnosing many different diseases.

Prior preparation of the patient
To obtain images properly, it is necessary to prepare the bowel to reduce the quantity of intestinal feces and gas, so that they do not interfere with the visualization of the UT. This preparation entails:
- **Abundant hydration** 24 h before performing the exam. Although dehydration enhances the concentration of the contrast medium, it implies higher renal risk.
- **Bowel preparation:**
  - *Food restrictions*: putting the patient on a low-residue diet, avoiding dairy products, fruit, vegetables, nuts, rice, whole grain breads, and red meat 48 h before the exam and total fasting for at least 6-9 h before.
  - *Sodium dihydrogen phosphate (ENEMA CASEN®)*: one enema 12 h and another 30 m before the exam. Alternatively, the administration of an oral bowel evacuant such as sodium picosulfate/magnesium citrate (CITRAFLEET®) dissolved in a glass of cold water taken in two doses 18 and 12 h before the scan. Patients must drink 250ml of water or other clear fluids per hour until bowel movements have ceased.

Iodinated contrast media
- **Currently, non-ionic, low-osmolarity iodinated contrast media are used** since they are less allergenic (causing adverse reactions in only 3% of cases).
- **Can be administered** in bolus or by drip infusion.
- **The dose to be administered ranges from** 1 mL/kg to 3 mL/kg of body weight in adults, preferably in infusion to reduce the risk of cardiovascular toxicity.
- **Side effects:**
  - *Cardiovascular toxicity*: transient cardiovascular alterations, minor changes in ECG, arrhythmias, and ischemia. These can be reduced by avoiding bolus administration.
  - *Acute renal toxicity*: kidney failure risk is less than 1%. It is produced by direct toxicity in the renal tubule, medullary ischemia, renal vasoconstriction, or precipitation of uric acid in the renal tubule. Hydration in the 24 h period prior to the procedure is important for reducing the risk, as is the use of non-ionic contrast media of low osmolarity and the avoidance of too high a dose.
  - *Adverse reactions*: may be idiosyncratic or dose-dependent. Reactions can range from mild (*nausea, vomiting, urticaria, and facial edema*) to severe (*bronchospasms and anaphylactic shock*).
- **Contraindications**: no absolute contraindications. Relative contraindications are:
  - *Previous allergic reaction*: if this was not severe, the procedure can be performed under premedication with corticosteroids and antihistamines.
  - *Shellfish allergies*.
  - *Renal failure*: patients with blood creatinine levels >1.2 ng/mL are at increased risk for nephropathy due to contrast media.
**Procedure**

The procedure consists of obtaining different X-rays after iv administration of an iodinated contrast medium. The sequence is:

- **Plain abdominal X-ray**: must be performed prior to administration of iodinated contrast. Helps verify the technical quality of the exam, bowel preparation, and the presence of radio-opaque stones in the UUT (*See chapter on KUB X-ray*).

- **Intravenous administration of iodinated contrast medium** (50 or 100 mL, depending on patient’s weight).

- **Nephrographic phase**: 1-2 min after administration, the intravenous contrast opacifies the renal parenchyma. Allows visualization of the renal contour and detection of space-occupying avascular lesions.

- **Pyelographic phase**: 5 min after the injection, the collecting system is contrasted and elimination should begin.

- **Other X-rays**: the number of X-rays or different projections to be made depends on the patient’s age, the indications for the exam, or the pathology being tested. The entire length of the ureter and its peristalsis should be documented.

- **Specific projections**:
  - *Oblique projections* may better define the pyelocalyceal system and lacunar defects.
  - *Images taken with the patient in prone decubitus* position capture the ureter at a greater incline, which often helps obtain images of the ureter with a higher degree of distension.
  - Images taken with the patient *standing on both feet* may identify a *renal ptosis* or a significant *hydronephrosis*.

- **Cystogram phase**:
  - Evaluates the completely contrasted bladder.
  - Provides information on bladder capacity.
  - Helps identify filling defects or bladder diverticula.

- **Postvoid phase**:
  - Allows evaluation of postvoid residual urine.
  - Helps identify bladder diverticula or the presence of lacunar images inside the bladder.