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JCAHPO Regional Meetings
2017
FLUORESCIN ANGIOGRAPHY

1. History

   a. **Fluorescein angiography (FA)**, **fluorescent angiography (FAG)**, or **fundus fluorescein angiography (FFA)** is a technique for examining the circulation of the eye, specifically the **retina** and underlying **choroid**, parts of the **fundus**, using a **fluorescent** dye and a specialized camera. The dye highlights the blood vessels in the back of the eye so they are more visible and can be photographed.

   b. Medical Students 1961 - It involves administration of sodium **fluorescein**\(^1\) into the circulation, and then an **angiogram** is obtained by photographing the fluorescence emitted after illumination of the retina with blue light at a **wavelength** of 490 **nanometers**.

   c. The test uses the **dye tracing** method. The fluorescein is usually injected into a small vessel in the hand or arm in **intravenous fluorescein angiography (IVFA)** and given orally to drink in **oral fluorescein angiography (OFA)**.

   d. Fluorescein angiography does not involve the use of **ionizing radiation** (NO X-rays).

2. Preparing Patient

   a. **Put them at ease.**

      **Routine imaging procedure- done all the time**

      Tell the patient that their urine will be dark yellow orange for the next 2-3 days while their body naturally pees the dye out. (Saliva?)

      Let them know common side effects (nausea, vomiting, itching) and the small risk of allergic reaction that you are prepared to treat immediately

   b. **Get an INFORMED CONSENT form Signed.**

   c. **Be organized (Draw up dye prior to clinic... have a slick system)**

3. Equipment

   **Exciter filter:** Allows only blue light to illuminate the retina. Depending on the specific filter, the excitation wavelength hitting the retina will be between 465-490 nm. Most only allow light through at a wavelength of 490 nm.

   **Barrier filter:** Allows only yellow-green light (from the fluorescence) to reach the camera. Both filters are **interference bandpass filters**, which means they block out all light
except that at a specific wavelength. The barrier filter only allows light with a wavelength of 525 nm, but depending on the filter it can be anywhere from 520-530 nm.

**Fundus Camera**, either digital or with camera body containing black and white, or slide positive film

### 4. Technique

**PRIOR TO INJECTION**

- Baseline COLOR FUNDUS PHOTOGRAPHS
- The red-free filtered images (Black & White)…The black and white images are filtered red-free (a green filter) to increase contrast and often gives a better image of the fundus than the color picture.

**INJECTION**

- A 6-second **bolus** injection of 2-5cc of sodium fluorescein into a vein in the arm or hand
- Black-and-white or digital photographs are taken of the retina before and after the fluorescein reaches the retinal circulation (approximately 10-12 seconds after injection). The early images allow for the recognition of autofluorescence of the retinal tissues. Photos are taken approximately once every second for about 20 seconds, then less often. A delayed image is obtained at 5 and 10 minutes. Some doctors like to see a 15-minute image as well.
- A filter is placed in the camera so only the fluorescent, yellow-green light (530 nm) is recorded. The camera may however pick up signals from **pseudofluorescence** or **autofluorescence**. In pseudofluorescence, non-fluorescent light is imaged. This occurs when blue light reflected from the retina passes through the filter. This is generally a problem with older filters, and annual replacement of these filters is recommended. In autofluorescence, fluorescence from the eye occurs without injection of the dye. This may be seen with **optic nerve head drusen**, **astrocytic hamartoma**, or calcific scarring.
- Black-and-white photos give better contrast than color photos, which aren't necessary since only one color is being transmitted though the filter

### 5. Normal circulatory time (**Times are approximate**)

- 0 seconds – injection of fluorescein
- 9.5 sec – posterior ciliary arteries
- 10 sec – **choroidal** flush (or "pre-arterial phase")
- 10–12 sec – retinal arterial stage
- 13 sec – **capillary** transition stage
- 14–15 sec – early venous stage (or "laminar stage", "arterial-venous stage")
- 16–17 sec – venous stage
- 18–20 sec – late venous stage
- 5 minutes – late staining
Fluorescein enters the ocular circulation from the internal carotid artery via the ophthalmic artery. The ophthalmic artery supplies the choroid via the short posterior ciliary arteries and the retina via the central retinal artery, however, the route to the choroid is typically less circuitous than the route to the retina. This accounts for the short delay between the "choroidal flush" and retinal arterial stage.

6. Pathologic findings – (PowerPoint)

7. ICG – (IndoCyanine Green) used to better see the underlying vascular choroid

8. Dosing Form & Strengths

   a. Injection Solution
      • 10%
      • 25%

   b. Oral (off-label) Some Kids
      • Administer 1g of injection solution orally in Orange Juice
      • Clarity of photographs reportedly poorer than photographs obtained following IV administration
      • Need to see CME wait 20-30 minutes

9. Ophthalmic angiography review

   • If allergy reaction a possibility,
   • intradermal test dose of 0.05 mL; evaluate 30-60 min following intradermal injection
   • a negative test dose does not exclude potential for allergic reaction
   • immediate treatment for anaphylaxis
   • including epinephrine 1:1000 should be available during the procedure (we call 911)
   • Intravenous
     • Lidocaine Gel
       • Topically over 2 areas and let it sit for a minute
       • Administer using a 23 gauge needle (we use Butterfly)
       • Children and small veins 25 G
       • Take steps to ensure needle has not extravasated prior to turning off room light
       • Administer 500 mg as single dose IV into antecubital vein
       • If highly sensitive imaging system used (eg, scanning laser ophthalmoscope), may administer a dose of 200 mg
       • Inject dose into hand or antecubital vein over 5-10 seconds
       • Luminescence appears 7-30 sec following injection
       • Maintain venous access following procedure in event treatment is needed for anaphylaxis
10. ADVERSE EFFECTS

a. Frequency Not Defined, the following list are the most common:

Pruritus = Itching

GI distress – Nausea &/or Vomiting

Skin discoloration (yellow)

Hives

Urine discoloration (customary) – dark yellow/orange urine for 2-3 days

Taste disturbance

Seizure

Dizziness

Headache

Hypotension = Lowered Blood Pressure & weakness (so steady the patient & stand slowly & walk slowly afterwards)

Cardiac arrest (rare)

Shock (rare)

Syncope (rare) = temporary loss of consciousness caused by a fall in blood pressure

Basilar artery ischemia (rare)

Dermatitis

Extravasation = leakage of intravenously (IV) infused dye into the extravascular tissue around the site of infusion

Thrombophlebitis

Bronchospasm
b. Postmarketing reports

Pulmonary edema (acute)

Respiratory arrest

Sickle cell crisis

Localized nerve palsy

Hemolytic anemia

c. Contraindications

- Hypersensitivity to components or mercury-containing compounds
- History of hypersensitivity to fluorescein sodium

d. Cautions

- Severe local tissue damage, including phlebitis, skin sloughing, toxic neuritis, may occur from extravasation; use caution; discontinue immediately if extravasation occurs
- Use caution in patients with history of hypersensitivity, allergies, or asthma
- Skin may turn yellow within few minutes of administration and fade in 6-12 hr; urine may appear bright yellow for 24-36 hr
- Not for intrathecal or arterial administration
- Nausea and/or vomiting and gastrointestinal distress may occur commonly within few minutes following injection; may subside within 10 min, so always have nearby emesis basin &/or lined trashcan and treat patient gently
- Remove contact lenses before use to avoid staining; after exam, flush eye with saline eye drops and wait at least 1 hr before reinserting contact lenses
e. The Pregnant Patient

- There are no reports of fetal complications during pregnancy.
- Fluorescein is Pregnancy Category C = Use with caution if benefits outweigh the risks; most will avoid during pregnancy, especially in the first 3 months.
- Breastfeeding; Fluorescein is excreted in breast milk.

- Pregnancy Categories

A: Generally acceptable. Controlled studies in pregnant women show no evidence of fetal risk.

B: May be acceptable. Either animal studies show no risk but human studies not available or animal studies showed minor risks and human studies done and showed no risk.

C: Use with caution if benefits outweigh risks. Animal studies show risk and human studies not available or neither animal nor human studies done.


NA: Information not available

11. PHARMACOLOGY

Mechanism of Action

WATER-SOLUBLE Indicator dye and diagnostic aid; emits fluorescence when exposed to blue wavelength

Distribution

Vd: 0.5 L/kg

Elimination

Excretion: Urine

Metabolism …Rapidly metabolized to fluorescein monoglucuronide (80%) within 1 hr following IV administration
12. PHOTOGRAPHY CHECKLIST

- Create New Patient “database” entry or choose existing patient for re-examination.
- Move the camera to the farthest back position.
- Clean camera chinrest and forehead rest - preferably when patient can see you doing so.
- Check that lens is clean also.
- Adjust table height and chinrest for the patient.
- Turn camera on.
- Select ACQUISITION MODE using the selection knob for your camera.
- Ask patient to place their chin on the chinrest and to lean their forehead against the forehead rest.
- Align camera with the patient’s pupil and move camera forward.
- Acquire images.
- Move camera backwards and then over to the fellow eye.
- Acquire images of the fellow eye.
- Exit Acquisition window. Images may be automatically saved but different systems vary
- Select and delete any low quality or duplicate images.