Injectable medications in eye care

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Injectable Medications in Eye Care

- No financial disclosures

Injections by OD’s

- Allowed in 36 states
- 22 of those allow for counteraction of anaphylaxis only
- 14 allow for varying degrees of diagnostic and therapeutic use

Types of injections

- Subcutaneous
- Intramuscular
- Intravenous
- Periocular
- Intraocular
- Always ask about allergies!

NBEO

- Injections a permanent NBEO Part III station
- Sterile technique
- IM
- IV
- Model arm pads only

Sterile draw technique

- Gloves
- Alcohol swab cleaning of vial top
- Always inject an amount of air into vial first that is equal to amount of desired fluid removal: Vacuum sealed
- After draw, remove any air from syringe before use
Sharps

- All needles disposed of in a sharps container

One hand scoop technique: NBEO

- Needle used only for the drawing up of a fluid to be capped using the "one hand scoop technique"

Re-capping needles

- Needles that have been used on people are never re-capped before discarding them
- High risk of "stick" with contamination

Syringe basics

- 1ml (TB)
- 3ML
- 5ML
- Larger (less common except for blood draws)

Needles / Syringes

Needle basics

- Bevel
- Gauge: larger number = smaller needle
- 19, 23, 25, 27, 30
- May have second # indicating length: 27 ½ G
**Injection sites**

- **Subcutaneous**
  - Deposits medication below the skin
  - Can use any site that is not over a bony structure and is free of large blood vessels and nerves
  - Typical sites include the thigh, back of the arm, and abdomen
  - CPT code 96372

**Subcutaneous sites**

**Subcutaneous technique**

- Clean site
- Pinch skin
- Insert needle at 90 degree angle (chalazion or TB stick tangential)
- Inject medication
- Release skin

**Subcutaneous**

- Medication absorbed more slowly when injected in this manner than with intramuscular or intravenous injections
- Requires small, thin needles which are short
- Used with insulin, anesthetics, PPD testing, copaxone
- Good for small doses of non-irritating solutions. Bad for larger volumes and irritating solutions
Intramuscular

- Deposits medication into muscular tissue free of major vessels and nerves
- Typically given in the deltoid or gluteus muscles (outer buttocks)
- Much more rapid onset of action than SQ route due to the greater blood supply of the tissue
- Good for concentrated or oily substance
- Requires thick, long needles (epipen and obesity?)
- CPT code 96372

Intramuscular technique

- Clean site
- Pull skin taught
- Insert needle at 90 degree angle
- Dart like motion
- Inject medication

Intravenous

- Utilized in eye care for IVFA, ICG angiography, and laser assisted macular surgery (visudyne, etc.)
- Very rapid onset of action
- Greater chance of early onset allergic response
- Remember... once a medication is injected by any means it cannot be retrieved!

IV injections: tools

- Must first fill 3 or 5 CC syringe with fluorescein using large fill needle
- Then discard that needle and attach butterfly tubing: the shorter the better!

IV Injections: technique

- Place tourniquet on upper arm (downstream from injection site)
- Locate vein in antecubital space (preferred) or back of hand (if you must)
- Saline in tubing vs. 10% dye vs. empty?
- With bevel up, inject butterfly needle (23 – 25 gauge) in to vein at an angle of around 30 degrees

IV technique
**No good!**

**IV Injections**
- Draw back on syringe to get blood flow in to tubing (difficult to see blood if tube filled with 25% dye)
- Remove tourniquet and inject 3-5 cc of dye depending upon %

**Periocular injections**
- Intralesional
- Subconjunctival
- Subtenons
- Peribulbar/local anesthetic blocks
- Specialty uses - botulinum toxin

**Intralesional injections**
- Utilized in the treatment of chalazia and less frequently pyogenic granulomas. Form of subdermal/SQ injection
- Inject steroids into the lesion to hasten resolution
- Typically will use kenalog 10 or 40 mg/ml (triamcinalone) or dexamethasone 2.0 mg/ml or 4.0 mg/ml
- Dexamethasone is a clear solution and is more readily absorbed than the kenalog suspension - more later!

**Intralesional injection**
- Utilize TB syringe with 27 or 30 gauge needle
- Bevel up
- Inject approximately .2 cc of steroid (usually kenalog) in to lesion
- Can do skin side or palpebral side; skin side more comfortable. Can’t really pinch skin
- Lesion may be too hard

**Intralesional injections**
- Contraindications/adverse reactions include allergic responses and skin depigmentation with kenalog (questionable - personal experience)
- Follow up in two weeks....some lesions will require a second injection
- Billable procedure with its own CPT code 11900, 11901 if more then seven!
Intralesional injection

Subconjunctival injections

- Used to deliver high dose of long acting steroid or antibiotic to the anterior segment
- Main uses include steroid delivery in cases of recalcitrant inflammation or CME as well as post operative administration of antibiotics and steroids
- Can give antibiotic injection for severe corneal ulcers or in endophthalmitis cases

Subconjunctival injections

- Adverse reactions include allergic response and increased IOP with steroids
- IOP elevation can be difficult to control because med can not be "discontinued" like with topical steroids
- Can occur weeks to months after the injection
- Can occur with long history of not pressure responding to topical steroids
- Dexamethasone or Durezol trial?

Subconjunctival injections

- Perform on bulbar conjunctiva under upper lid or lower lid (hides any subconj. heme)
- Use jewelers / Calibri / ear forceps to tent conjunctiva and create potential space
- Insert small gauge needle bevel up in to space, release conjunctiva, and inject .1-.2 cc
- CPT code 68200

Subconjunctival injection

Calibri forceps
Subtenons injections
- Similar to subconjunctival in uses and indications
- Only difference in procedure is that the needle penetrates Tenon’s capsule
- Indications include pars planitis or other forms of intermediate uveitis and CME
- In the majority of cases this technique holds little advantage over a more simple subconjunctival injection
- Possible route for new glaucoma drugs in development

Subtenons injection
- Utilizing small needle (27 or 30 gauge), insert needle into lower fornix where bulbar and palpebral conjunctiva meet
- Move needle laterally and observe globe to ensure no movement
- Inject approximately .2 cc
- CPT code 67515

Intravitreal injections
- Kenalog, Lucentis, Avastin, Macugen, Eylea, Jetrea
- Many uses

Intravitreal injections
- Not routinely performed by OD’s right now in any state
- What about nurses? Eye 2014; 28 (6):734-740. Retinal specialists in England trained NP’s to give intravitreal shots. Out of 4000 shots, the only complication was SCH (5.7%)

Anesthetic application
- Done to prepare for surgical procedures such as lid lesion removal, chalazion excision, etc.

Peribulbar block
Specialty uses - Botulinum

- Botulinum toxin is derived from the organism that is responsible for botulism
- It is a very powerful neurotoxin and its use results in paralysis of muscles
- It is utilized in the management of blepharospasm and strabismus
- Also used by plastic surgeons and dermatologists to temporarily remove wrinkles

Botulinum

- In blepharospasm cases, it is injected SQ at several locations to paralyze affected muscles and eliminate or decrease the spasm
- Has to be repeated every few months
- Complications include ptosis and exposure problems secondary to incomplete lid closure

Botulinum

- In strabismus, the injection is directed into the muscle to be weakened (the overacting muscle)

Pharmacokinetics

- Absorption dependent upon several factors......
  - 1) route of administration
  - 2) concentration of medication
  - 2) solution / suspension (sol. Is more rapidly absorbed and shorter acting)

Steroids

- One of the most common medications delivered via injection when it comes to eye care
- Uses include chalazia, recalcitrant iritis, CME, pars planitis, and others

Injectable steroids

- Three main injectable steroids
  - 1) Dexamethasone
  - 2) Kenalog (Triamcinolone)
  - 3) Depo-medrol (methylprednisolone)
### Dexamethasone
- Dexamethasone 2.0 or 4.0 mg/ml
- Water soluble and very short acting
- Clear solution, not milky suspension like Kenalog
- Duration of action is often too short to be utilized effectively with uveitis or long-standing chalazia

### Kenalog
- Triamcinolone 10 or 40 mg/ml
- Suspension: slow absorption and moderately long acting
- Great choice for chalazia, sub-conjunctival / sub-tenons treatment of uveitis (usually 40 mg/ml)
- Watch for IOP increase and PSC!

### 10 mg/ml Kenalog

### Depo-medrol
- Depo (long acting) version of methylprednisone
- Very slowly absorbed and very long acting
- Duration of action is often too long to be practical (increased IOP, etc)

### Anesthetics
- Utilized to prep for lid lesion removal, etc.
- Injected subcutaneously at site
- Marcaine and Lidocaine (Xylocaine) available in 1% or 2% solutions with or without 1:100,000 epinephrine
- Epi decreases bleeding and loss of effect through systemic absorption

### Anesthetics
- Can have allergic response
- Other side effects include ptosis if injected in to Mueller’s muscle
- Use .5 to 1cc of medication so larger 3cc syringe often utilized
- Inject while withdrawing needle to spread coverage
**Botulinum toxin**
- Purified neurotoxin complex made from Botulinum toxin type A (Clostridium Botulinum) : Botox
- Comes in 100 unit vials, powder that is reconstituted with saline
- Used for blepharospasm, strabismus, cosmesis
- Side effects include ptosis, exposure
- Must be used within a few hours

**Intravenous Fluorescein Angiography**
- When do we do it?
- Not as often anymore: OCT / FAF

**Where is it better than OCT?**
- Evaluating surface neovascularization.......is it neo or is it not?
- In some instances it is better with SRNVM
- PED with no obvious SRNVM on OCT
- Some choroidal pathology (ICG)
- Coat’s / IJXT

**What is it?**
- Sodium fluorescein is an inert dye that is yellow-orange in color. 10% and 25% strengths
- Absorbs wavelengths in the blue range and fluoresces at 520-530 nm.
- When injected intravenously, the dye leaks from all vessels except those in the central nervous system including the retina

**How does it work?**
- Around 80% of the dye binds to plasma proteins such as albumin leaving 20% free to fluoresce
How do we do it?
- Always obtain informed consent first!
- Seat patient at the retinal camera
- Begin by taking a color photo of each fundus

How do we do it?
- Locate an acceptable vein. The antecubital space is preferred but the back of the hand and rarely others can be used
- Clean the site with alcohol pad

Tourniquet
- Apply a tourniquet downstream to the injection site.
- With a vein, “downstream” is toward the heart

How do we do it?
- Inject 5ml of 10% (3ml of 25%) dye into the vein at a rate of 1ml per second (always pull back on syringe first to ensure blood return confirming that a vein has been hit).
- Injecting too quickly causes nausea, too slowly results in poor early pictures
- Start timer when the injection begins

Fluorescein Dye

10% dye vs 25% dye
- Less nausea / vomiting with 10% (100mg/ml)
- Have to use more 10%: 5ml vs. 3ml of 25%
How do we do it?

- Begin taking photos at the first sign of fluorescence (standard arm to retina transit time is 10-15 seconds)
- Take one shot per second for the first 10 seconds or so then shoot areas of interest
- Take several photos at the mid-phase, approximately 1 ½ to 2 minutes post injection
- Remove the butterfly infusion (which had been taped to the patient's arm) and apply a band aid

What can go wrong?

- Side effects are usually mild but serious reactions can occur (must always have a crash cart available with epi-pen)
- Contraindications include a known sensitivity to fluorescein contrast dye, pregnancy, and lactation

What's normal?

- The choriocapillaris has fenestrations which allow the dye to leak into the extravascular space
- The RPE serves as a barrier to prevent this dye from leaking forward and also limits its visibility
- Normal retinal vessels do not leak dye

How do we do it?

- Shoot several shots during the late phase 8-10 minutes after injection
- If doing both eyes, have to go back and forth.

What can go wrong?

- Yellowing of the skin and urine always occurs. Urine can remain orange for over 24 hours
- Nausea and vomiting happen in approximately 15% of patients. Conveniently, this often occurs around the time of the mid-phase so the test can be completed after it passes! The sensation usually passes very rapidly and actual vomiting occurs far less frequently than nausea

What can go wrong?

- Extravasation of the dye can lead to tissue necrosis in 1-2% of cases
- Hives are possible and severe anaphylactic responses occur in approximately .05% of patients
- The reported death rate associated with IVFA is approximately .00045%
The angiogram progresses through many stages:

1. **Choroidal flush.** The choroid takes on a patchy, flushed appearance as dye enters the eye. This is blocked in the macula due to increased pigment.

2. **Arterial phase.** Dye rapidly fills the retinal arteries. This phase is over in a few seconds.

3. **Arteriovenous phase.** After the retinal arteries fill, the veins begin to fill. Initially, this filling is along the walls of the veins (laminar flow) due to the rapid movement of RBC's in the central lumen. This phase lasts until the lumen fills entirely and typically covers only 5-10 seconds.

4. **Venous phase.** Arteries and veins are of equal intensity.

5. **Late Venous phase.** The intensity in the veins is greater than that in the arteries.

6. **Recirculation phase.** Fluorescence progressively lessens as dye leaves the system.

7. **Late phase.** Occurs 5-10 minutes after injection. Arteries and veins are essentially void of dye and the choroidal flush is minimal. Optic nerve head will still show fluorescence. In thirty minutes all traces of dye will be gone from the eye.
What’s not normal?

- Abnormalities can be broken down into two main categories: hypofluorescence and hyperfluorescence.
- Increased vein to eye filling time can be indicative of a systemic vascular abnormality or occlusion.
- Hypofluorescence is the result of either a filling defect or blockage.

What’s not normal?

- A filling defect is the result of capillary non-perfusion (diabetes, post vein occlusion) or a blockage such as an arterial embolus or sickle cell induced clot. Arteriosclerosis can also result in a lack of filling.
- Hypofluorescence due to blockage is the result of some entity blocking the background fluorescence of the choroidal flush or obscuring the retinal vasculature.
What's not normal?

- Examples include pre-retinal, intra-retinal, and sub-retinal hemorrhages as well as exudates, pigment, and masses.
- Hyperfluorescence is the result of either loss of normal blockage of the background flush or leakage from abnormal vessels.

What's not normal?

- Window defects, atrophy and chorioretinal scars can lead to loss of the RPE and hyperfluorescence due to lack of blocking.
- Hyperfluorescence from leakage occurs with neovascularization, microaneurysms, edema, and compromised vessels.

What's not normal?

- Staining occurs normally with the borders of the optic nerve head and with the sclera. Druse will also stain.
PED comparison

Coat’s disease

Coat’s IVFA (courtesy Dr. Dan Neely)

Coat’s IVFA
IRVAN

Mystery eyes

Mystery revealed

Collaterals

Collaterals late
Metastatic tumors

What is ICG

- Indocyanine green is a water soluble dye that leaks less freely from choroidal vasculature than Fluorescein dye does
- The RPE blocks less of the emitted wavelength than with fluorescein, making ICG preferred for choroidal pathology
- 98% binds to plasma proteins

What is ICG?

- Inject into arm vein like fluorescein but test takes longer. Mid-phase is about 10 minutes after injection, late about 25
- Contraindications include pregnancy and lactation, known hypersensitivity, and allergy to iodine or shellfish

When do we use it?

- Choroidal pathology such as SRNVM's, AMPPE, angioid streaks, MEWDS, PCV, etc.

ICG / FA

Image: Youtube

ICG: PCV

Image: Strathfieldretina.com

The end!