Efficacy of Carbonic Anhydrase Inhibitors for Treating Macular Edema Secondary to Retinitis Pigmentosa

Abstract: 22 year old Asian male presents for retinal consult of macular edema OS once stopping topical CAI therapy for the treatment of Angle Closure Glaucoma, status post trabeculectomy OS.

I. Case History
- 22 year old Asian Male
- Concurrent care with our ophthalmologist who specializes in glaucoma
  - Patient has Chronic Angle Closure Glaucoma secondary to fist fighting trauma OS>>OD
- Chief complaint as seen by Retinal specialist in July, 2016
  - Vision in left eye is decreasing; difficulty with night time vision and peripheral vision getting worse
- Ocular history
  - Fist fighting trauma, OS>>OD
  - Chronic angle closure glaucoma OS>>OD; 2015
  - Peripheral Iridotomy OU; 2015
  - Trabeculectomy with MMC OS; 2016
- Medical history
  - Systemic health unremarkable
- Medications
  - No systemic medications
  - Before Trabeculectomy OS procedure performed in May, 2016
    - Brimonidine BID OU, Timolol BID OU, Dorzolamide TID OU, Latanoprost QHS OU
  - Current medications Post Trabeculectomy OS, May, 2016
    - Brimonidine BID OD, Timolol BID OU, Dorzolamide QAM OD, Latanoprost QHS OD, Prednisolone acetate Q2H OS, Ciprofloxacin QID OS
      - D/C Brimonidine, Dorzolamide, and Latanoprost OS
      - *MACULAR EDEMA OS FIRST NOTICED JUNE, 2016*; prompted retinal consult

II. Pertinent Findings
- Clinical Findings
  - VA: OD sc 20/20; VA OS sc 20/800, PH 20/200
  - Confrontation Fields: OD constricted, OS constricted
  - APD 1+ OS
  - Slit Lamp Examination
    - OD anterior chamber shallow but formed
    - OS anterior chamber shallow but formed
    - OS superior bleb, avascular with good diffuse flow
    - Temporal Peripheral Iridotomy OU
    - Lens OU clear
  - Applanation Tonometry
    - OD 10 mmHg
    - OS 10 mmHg
- TMAX OD 50mmHg, OS 54mmHg
  - Dilated Fundus Examination
    - Vitreous Clear OU
    - Optic Nerve Head Appearance
      - C/D OD 0.60/0.60, (-)pallor
      - C/D OS 0.95/0.95, (+)pallor
    - Macula
      - OD flat
      - OS cystoid macular edema
    - Vessels
      - Attenuated arterioles OU
  - Macula
  - Periphery
    - Bone spicules OU
- Ancillary Testing
  - Pachymetry
    - OD 571 um
    - OS 582 um
  - Visual Field Testing
    - Only from 2015, pt deferred testing in 2016
    - OD superior and inferior arcuate, macular sparing
    - OS, severely restricted 360
  - RNFL OCT
    - GCC loss OS>>OD
  - Macular OCT
    - Normal OD
    - Cystoid macular edema OS
- Laboratory Testing
  - Liver function tests
    - Normal, okay to start Vitamin A Palmitate 15,000 IU

III. Differential Diagnosis – Causes of Cystoid Macular Edema
- Ocular inflammation
  - Uveitis
- Retinal Ischemic Vascular Disease
  - Branch Retinal Vein Occlusion
  - Central Retinal Vein Occlusion
- Diabetic Retinopathy
- Complications from Ocular Surgery
  - Post laser photocoagulation
  - Post cryotherapy for retinal tears/detachments
  - Post cataract extraction, Irvine-Gass

IV. Diagnosis and Discussion
- Retinitis Pigmentosa
  - Inherited disorder
  - Prevalence of 1:3000 to 1:5000
• Rod photoreceptor cell death by apoptosis
  • Shortened, disorganized, or complete loss of rod photoreceptors
• Clumps of pigment in perivascular pattern in bone spicule arrangement
• Narrowing of arterioles
• Waxy optic disc pallor
• Progressive ring scotoma visual field loss

• Cystoid Macular Edema
  • Disruption of intrinsic balance between retina and choroid
    • Cyst like pockets of fluid that accumulate in the inner retina
    • Primarily in the outer plexiform layer/Henle’s fiber layer
    • Accumulation in central retina due to avascular component
  • Painless vision loss and reduction in contrast sensitivity
• Breakdown of blood retinal barrier
  • Retinal Pigmented Epithelium
  • Capillary endothelial cells; leakage evident of fluorescein angiography

V. Treatment and Management

• Randomized Trial of Vitamin A and Vitamin E Supplementation for Retinitis Pigmentosa
  o 15,000 IU/day Vitamin A Palmitate alone
  o 15,000 IU/day Vitamin A Palmitate and 400 IU/day Vitamin E
  o Trace amounts of Vitamins A and E
  o 400 IU/day Vitamin E
  o Results showed 15,000 IU/day Vitamin Palmitate alone slowed decline in vision annually whereas Vitamin E was proven detrimental to vision
  o Before administering dosage of Vitamin A Palmitate, liver function profile to be done

• Carbonic Anhydrase Inhibitors for Macular Edema
  o Alters polarity of ionic transport system in RPE
    • Inhibits carbonic anhydrase and gamma glutamyl transferase
    • Increases fluid transport across RPE
    • From subretinal space to choroid
  o Induces acidification of sub retinal space
    • Decreases standing potential
    • Increases retinal adhesiveness
  o Oral versus Topical therapy
    • Acetazolamide thought to be more beneficial with greater improvement in visual acuity
      • 500 mg/day for at least 1 month
    • Topical Dorzolamide showed improvement in visual acuity in patients with autosomal recessive Retinitis Pigmentosa
  o Side Effects of Carbonic Anhydrase Inhibitors
    • Diarrhea
    • Feeling of discomfort
    • Increase in urination
    • Loss of appetite
- Nausea or vomiting
- Numbness, tingling, burning in hands, fingers, feet, toes, mouth, lips, tongue
- Weight loss

Bibliography


VI. Conclusion
- Topical CAIs used to treat this patient’s glaucoma were serving a dual purpose; treating IOP for Angle Closure Glaucoma, and also serving as protective measure against macular edema secondary to Retinitis Pigmentosa
- Important to evaluate entire ocular health, anterior and posterior segment, before adding or eliminating current therapy
- Administration of CAIs to treat macular edema prove effective for RP and uveitis, but not in the treatment of macular edema secondary to retinal vascular abnormalities