ABSTRACT

• THIS COURSE DISCUSSES THE POTENTIAL PROS AND CONS OF PRACTITIONER RELIANCE ON THE OCT FOR THE DIAGNOSIS OF GLAUCOMA. THE COURSE WILL ALSO INCLUDE A REVIEW OF THE CLINICAL SIGNS OF A GLAUCOMATOUS OPTIC NERVE AND CLINICAL NERVE FIBER LAYER EVALUATION.

OBJECTIVES

• TO LEARN NOT TO ACCEPT THE RESULTS OF AN OCT AT FACE VALUE.
• TO LEARN TO RECOGNIZE THE CLINICAL INDICATORS OF A GLAUCOMATOUS OPTIC NERVE.
• TO LEARN TO RECOGNIZE CLINICALLY APPARENT NERVE FIBER LAYER LOSS.
• LEARN HOW TO INTERPRET THE OCT REPORTS WHEN EVALUATING A PATIENT SUSPECTED OF HAVING GLAUCOMA.

GLAUCOMA SUSPECT

“AN INDIVIDUAL WITH CLINICAL FINDINGS AND / OR A CONSTELLATION OF RISK FACTORS THAT INDICATE AN INCREASED LIKELIHOOD OF DEVELOPING PRIMARY OPEN-ANGLE GLAUCOMA.” AAO PPP

THE GLAUCOMA SUSPECT WORK-UP

• VA
• PUPILS
• SLIT-LAMP
• IOP
• CENTRAL CORNEAL THICKNESS
• GONIOSCOPY
• FUNDUS EVAL (DILATED)
• MAGNIFIED, STEREOSCOPIC EVALUATION OF
  • ONH
  • RNFL
• DOCUMENTATION OF ONH
  • STEREOPHOTOGRAHY OR
  • COMPUTER BASED ANALYSIS
• VISUAL FIELD BY AUTOMATED PERIMETRY
WHAT DOES THE AAO SAY ABOUT ONH DOCUMENTATION / ANALYSIS?

• Appearance of ONH should be documented
  • Color stereophotographs are acceptable
  • Computer analysis of ONH and RNFL is an alternative

• 3 types of computer based imaging
  • Similar in ability to distinguish glaucoma from controls
  • Useful, when analyzed in conjunction with other relevant clinical parameters

• Each method is complimentary

COMPUTER BASED ANALYSIS TRENDS IN DIAGNOSTIC TESTING STUDY

• 2001-2009
• Managed care network
• Patients of OD or MD
• > 40 yo, at least 1 visit
• Diagnoses
  — OAG = 169,917
  — OAG suspects = 395,721

• Rates of change
  — Imaging
    • Ophthalmologists increased but not as much as optometrists
  — Visual fields
    • Ophthalmologists decreased but not as much as optometrists

GROWTH OF THE OCT

WHY THE INCREASE IN USAGE OF COMPUTER BASED ANALYSIS?

“HIGHLIGHTS” RNFL EVALUATION EVOLUTION

1991 Clinical NFL loss precedes VF loss by 6 years
1991 First OCT developed
1995 First glaucoma OCT developed
2000 RNFL phoptos vs time domain OCT are similar
2006 Time domain OCT predicts early glaucoma
2009 Spectral domain OCT similar to time domain
2011 Spectral domain OCTs are all similar

SPECTRAL DOMAIN OCT OPTIONS AS OF FEBRUARY 2014

• Greatest market share
  • Zeiss
  • Optovue
  • Heidelberg
  • Topcon
WHAT IS “RED DISEASE”?  
• RED DISEASE  
  – FALSE POSITIVES  
    • A RED OCT THAT IS BELIEVED TO BE GLAUCOMA BUT MAY BE INDICATIVE OF ANOTHER DISEASE OR JUST RED AS A RESULT OF POOR IMAGING QUALITY

POTENTIAL CAUSES OF “RED DISEASE”  
• ANATOMIC ANOMALIES  
  – LARGE OPTIC NERVES  
  – TILTED DISC SYNDROME  
• MEDIA OPACITIES  
  – LENS  
    • OPERATOR DECENTERS CIRCLE TO GET BETTER VIEW  
      – IMPACTS SUPERIOR / INFERIOR MEASUREMENT  
        » WHERE GLAUCOMA IS INITIALLY DETECTED  
  – DRY EYE  
  – CORNEAL OPACITIES  
  – VITREOUS FLOATER  
  – SHADOWING  
    • *ALL MAY REDUCE SIGNAL STRENGTH*

OTHER POTENTIAL CAUSES OF “RED DISEASE”  
• REFRACTIVE ERROR  
  – MYOPIA  
  • PERIPAPILLARY ATROPHY  
• OTHER DISEASES  
  – DM MACULAR EDEMA / AMD  
  • INCREASED REFLECTIVITY FROM CYSTS, EXUDATES, HEMES  
  – GLAUCOMA MASQUERADERS  
    • OPTIC NEUROPATHY FROM  
      – SYPHILIS  
      – OPTIC NEURITIS (MS)  
      – ISCHEMIC OPTIC NEUROPATHY  
      – COMPRESSIVE OPTIC NEUROPATHY  
      – TOXIC OPTIC NEUROPATHY  
      – ARTERY / VEIN OCCLUSION  
      – OPTIC NERVE HEAD DRUSEN

WHY IS RECOGNIZING “RED DISEASE” IMPORTANT?  
• ASSUMING AN ABNORMAL RNFL OCT IS ONLY DUE TO GLAUCOMA COULD LEAD TO  
  • RELIANCE ON A MACHINE THAT IS NOT 100% SENSITIVE OR SPECIFIC  
  • MISDIAGNOSIS OF OCULAR DISEASES  
  • MISSING AN OCULAR MANIFESTATION OF A SYSTEMIC DISEASE  
  • OVER TREATMENT

“RED DISEASE” PREVENTION  
• AS THE PROVIDER OF CARE  
  • UNDERSTAND THE STRENGTHS AND WEAKNESSES OF THE MACHINE  
  • TRAIN YOUR TECHNICIANS WELL  
  • EDUCATE THE PATIENT  
    • EXPLAIN WHY TEST IS BEING DONE

“RED DISEASE” PREVENTION  
• OPERATOR / TECHNICIAN  
  • UNDERSTAND NEED FOR GOOD DATA  
  • EDUCATE, WORK WITH THE PATIENT  
  • CENTER THE OPTIC NERVE  
  • ENCOURAGE GOOD FIXATION  
  • INSTILL LUBRICATING DROPS AS NECESSARY  
  • BLINK RIGHT BEFORE IMAGES ARE ACQUIRED  
  • REPEAT UNTIL A GOOD SCAN IS ACHIEVED

“RED DISEASE” PREVENTION  
• MUST OBTAIN GOOD SIGNAL STRENGTH / QUALITY  
  • OCT  
    • STRATUS / CIRRUS > 5 IS MINIMUM  
    • PREFER > 8 FOR BEST QUALITY  
      • DATABASE FOR CIRRUS IS ALL > 6  
    • SPECTRALIS > 18 IS RECOMMENDED PER COMPANY REPS  
      • ACTIVE TRACKING / IMAGE LOCK, LOCKS THE IMAGE TO THE FUNDUS  
      • AVAILABLE ON SPECTRALIS AND CIRRUS UPGRADES  
  • HRT  
    • < 30 PER COMPANY REPS, < 40 HRT STILL REPORTS ACCEPTABLE  
  • GDX  
    • > 7 PREFERRED, CENTERED AND EVENLY ILLUMINATED
REMINDER
- Retinal nerve fiber layer loss is not specific for glaucoma
- RNFL loss can be caused by
  - Any optic neuropathy
  - Any retinopathy
- In other words
  - Disorders other than glaucoma can cause a yellow or red RNFL on the OCT
  - Clinicians must see the entire picture
  - If other clinical findings do not point towards glaucoma, go looking for another cause

WHAT IS “GREEN DISEASE”? 
- Green Disease
  - False negative
    - A green OCT that is believed to be normal but actually has clinically detectable evidence of glaucoma found by methods of testing other than just looking at the colors on the OCT

WARNINGS ABOUT “GREEN DISEASE”
- Automation complacency
  - Computer lulls us into a false sense of security
- Automation bias
  - When we place too much faith in the accuracy of the information coming through
- Examples of who is at risk?
  - Average people, Inuit hunters, airline pilots, lawyers, bankers, architects, doctors

REMINDER
- Sometimes glaucomatous optic nerves can have a green RNFL on the OCT
  - Be careful
  - The OCT should match the
    - Clinical optic nerve evaluation
    - Clinical retinal nerve fiber layer evaluation
    - Visual field
  - Trust your training and not just the machine

POTENTIAL CAUSES OF “GREEN DISEASE”
- Letting the machine make the diagnosis
  - Thinking green is always good
  - Not looking critically at the OCT
- Missing other signs of glaucoma
  - In other words
    - Just because the RNFL is green on the OCT, it does not mean the patient is normal
    - Proceed with caution

“GREEN DISEASE” PREVENTION
- Get back to basics
  - Look clinically for signs of glaucoma
    - The optic nerve
    - The retinal nerve fiber layer
    - The visual field
  - Look critically at the OCT

CLINICAL FINDINGS CHARACTERISTIC OF POAG AAO PPP 2010
- Optic nerve
  - Disc structural abnormalities
    - Especially at superior / inferior poles
      - Diffuse thinning of rim
      - Focal narrowing of rim
      - Notching of rim
  - Documented, progressive thinning of neuroretinal rim with increased cupping
  - Disc rim / peripapillary RNFL hemorrhages
  - Optic disc rim asymmetry
    - With loss of neural tissue
CLINICAL FINDINGS CHARACTERISTIC OF POAG AAO PPP 2010
- RETINAL NERVE FIBER LAYER
  - ABNORMALITIES
    - ESPECIALLY AT SUPERIOR / INFERIOR POLES
      - DIFFUSE LOSS
      - LOCALIZED LOSS

CLINICAL FINDINGS CHARACTERISTIC OF POAG AAO PPP 2010
- VISUAL FIELD ABNORMALITY
  - "MUST BE RELIABLE AND REPRODUCIBLE"
  - CONSISTENT WITH RETINAL NERVE FIBER LAYER DAMAGE
    - NASAL STEP
    - ARCUATE DEFECT
    - PARACENTRAL DEPRESSION IN CLUSTERS
  - DIFFERENCE IN HEMIFIELD
  - ABSENCE OF OTHER EXPLANATIONS

VISUAL FIELDS
- FIELD LOSS IS AN INDICATOR OF ADVANCED DISEASE
- EARLY IN DISEASE
  - FOLLOW OPTIC NERVE FOR CHANGES
- LATE IN DISEASE
  - FOLLOW VISUAL FIELD FOR CHANGES
    - MAY HAVE TO CONSIDER 10-2, MACULA
    - ESTERMAN FOR DRIVING, KINETIC III4E FOR LEGALLY BLIND
- COMMON GLAUCOMATOUS VF DEFECTS
  - THE ARCUATE DEFECT
  - THE NASAL STEP
  - THE PARACENTRAL DEFECT
  - DIFFUSE VISUAL FIELD LOSS

MINIMUM DIAGNOSTIC CRITERIA FOR A GLAUCOMATOUS VISUAL FIELD
- TWO “OUTSIDE NORMAL LIMITS” ON GHT OR
- CLUSTER OF THREE OR MORE POINTS IN A LOCATION CHARACTERISTIC FOR GLAUCOMA, ALL DEPRESSED ON PATTERN DEVIATION PLOT AT A P < 5% AND ONE DEPRESSED AT A P < 1% ON TWO CONSECUTIVE FIELDS (24-2 COUNTS EDGE POINTS, 30-2 ONLY COUNTS 2 NASAL PTS), ALL PTS RESPECT HORIZONTAL MERIDIAN

STRUCTURE / FUNCTION RELATIONSHIP
- 2002 OHTS
  - 35% PATIENTS HAD VF LOSS WITHOUT SIGNS OF STRUCTURAL PROGRESSION
- 2009 STUDY
  - 34% OF GLAUCOMA SUSPECT CONVERTERS PROGRESS WITHOUT STRUCTURAL CHANGES
C/D RATIO

"WHEN A CLINICIAN EXAMINES A PATIENT FOR THE FIRST TIME, THERE IS NO WAY TO DETERMINE WHETHER THE C/D RATIO OBSERVED HAS BEEN STABLE DURING THE PATIENT’S LIFETIME OR HAS ENLARGED AS PART OF THE DISEASE PROCESS, ASSUMING THAT NO PREVIOUS PHOTOGRAPHS OR MEASUREMENTS ARE AVAILABLE FOR COMPARISON”

GORDON MO, ET AL.
THE OHTS: BASELINE FACTORS THAT PREDICT THE ONSET OF POAG
ARCH OPHTHALMOL 2002; 120: 701-713.

CUP TO DISC RATIO

- NO LINE SEPARATING NORMAL FROM GLAUCOMA
- NORMAL VERTICAL C/D RATIO VARIES FROM 0.00-0.85
- C/D RATIO OF > 0.65 OCCURS IN 2.2 - 4% OF NORMAL
- IS A FUNCTION OF DISC DIAMETER

Expected Physiologic Cup Size
Based on Measured Vertical Disc Diameter
Using a 60 Diopter Lens At The Slit Lamp

<table>
<thead>
<tr>
<th>Vertical Height (mm)</th>
<th>1.6</th>
<th>1.8</th>
<th>2.0</th>
<th>2.2</th>
<th>2.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected C/D ratio</td>
<td>0.0</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

HOW TO MEASURE OPTIC DISC DIAMETER

USE 60D LENS AT SLIT LAMP
IF NOT, USE CORRECTION FACTOR
MAKE THIN VERTICAL BEAM
ADJUST BEAM HEIGHT
READ HEIGHT OFF SCALE
> 2.2 mm IS A LARGE DISC
< 1.8 mm IS A SMALL DISC
THIS IS A ROUGH ESTIMATE
REFRACTIVE ERROR / WORKING DISTANCE INFLUENCE READINGS

OTHER METHODS
CAMERAS WITH SOFTWARE
ADVANCED IMAGING DEVICES
HRT
CALCULATES DISC AREA AND INDICATES SMALL / AVG / LARGE
OCT CIRRUS CALCULATES DISC AREA
- 1.06-3.38 mm² (avg 1.83)
- SMALL <1.63
- MEDIUM 1.63-1.97
- LARGE > 1.97

THE ISNT RULE
FIRST REPORTED BY JONAS ET. AL 1988
457 NORMAL EYES
INFERIOR RIM > SUPERIOR > NASAL > TEMPORAL
GLAUCOMA VIOLATES THE RULE
HOWEVER, NOT ALWAYS
2006 STUDY ARCH OPHTHALMOL
66 NORMAL EYES, 43 WITH OAG
ISNT RULE INTACT IN 79% OF NORMALS VS 28% OF OAG (P<0.001)

THE NERVE FIBER LAYER

- 700K-1.5 MILLION GANGLION CELLS
  - AXONS CROSS RETINA
  - CONVERGE TO MAKE THE ONH, EXIT THE EYE AT LAMINA ON WAY TO LGN
- SUPERFICIAL BENEATH ILM
- AN ORGANIZED PATTERN
- REFLECT LIGHT BACK
- THE THICKER THE RNFL THE BRIGHTER THE STRIATIONS
• SUPERIOR / INFERIOR POLES
• BEST SEEN AGAINST A DARK BACKGROUND
• DIFFICULT IN A BLONDE FUNDUS
• NEED CLEAR MEDIA

NORMAL RNFL FEATURES
• FINE WHITE LINEAR STRIATIONS
• IN ANTERIOR RETINAL LAYER
• BRIGHT STRIATIONS WITH A FULMINANT, COARSE TEXTURE
• CAST A WHITE HAZE OVER THE UNDERLYING RETINAL LAYERS
• TERTIARY BLOOD VESSELS ARE HIDDEN BENEATH THE RNFL
• BECOMES BRIGHTER AS YOU GET CLOSER TO THE ONH
• MOST PROMINENT IN THE SUPERIOR AND INFERIOR ARCADES
• BRIGHT-DIM-BRIGHT PATTERN

RNFL SLIT DEFECT
• EVIDENCE OF FOCAL OPTIC NERVE DAMAGE
• LARGER THAN AN ARTERIOLE WIDTH IN SIZE
• TRAVELS ALL THE WAY BACK TO THE NERVE
• ¼ mm WIDE = 50 um LOSS
• 50 um LOSS = 15,000 FIBERS
• 15,000 FIBERS = 1% OF TOTAL

RNFL WEDGE DEFECT
• EASIEST TO IDENTIFY BUT THE LEAST COMMON
• REPRESENTS EXPANDING LOSS OF GANGLION CELLS
• ASSOCIATED WITH NOTCHING OF OPTIC NERVE
• ASSOCIATED WITH A VISUAL FIELD DEFECT
• MAY OCCUR AFTER DISC HEME

DIFFUSE RNFL LOSS
• MOST COMMON
• HARDEST TO IDENTIFY
• LOSS OF STRIATIONS IN THE SUPERIOR AND INFERIOR ARCUATE BUNDLES
• RAKED OR THINNED APPEARANCE
• STRIATIONS ARE LESS BRIGHT
• TEXTURE IS FINER
• TERTIARY VESSELS ARE VISIBLE
• COMPARE SUPERIOR TO INFERIOR
• LOOK FOR RIM THINNING OR NOTCH
• COMPARE RIGHT TO LEFT EYE
• REVERSAL MAY OCCUR LATE IN DISEASE
  — DIM / BRIGHT / DIM

CLINICAL SIGNS OF RNFL LOSS

CIRRUS OCT
FROM CARL ZEISS MEDITEC

• SPECTRAL DOMAIN
  • 27,000 A SCANS / SECOND VS 400
  • 50X FASTER ACQUISITION
  • 5 um DEPTH RESOLUTION VS 10
  • CENTERS 1.73 mm RADIUS CIRCLE
  • 6 mm x 6 mm CUBE CREATED

• TESTING STRATEGIES
  • RNFL / MACULA
  • NEWER MODELS / SOFTWARE
    • AUTOCENTER FUNCTION
      • REPEATABLE?
    • GCC

CIRRUS ONH/RNFL ANALYSIS

• COLORS ARE NOT
  • NORMAL
  • THIN
  • LOSS

• COLORS ARE THIS PATIENT BEING COMPARED TO NORMALS
  • WHITE - UPPER 5% OF NORMALS
  • GREEN – MIDDLE 90% OF NORMALS
  • YELLOW – LOWER 5% OF NORMALS
  • RED – LOWEST 1% OF NORMALS
  • GRAY – NOT COMPARED

CIRRUS OCT NORMATIVE DATABASE

• 284 “NORMAL” PATIENTS
• QUALITY SCORE > 6
• AGE 19-84 (MEAN 46.5)
• REFRACTIVE ERROR -12 TO +8
• ETHNIC “DIVERSITY”
  • 43% CAUCASIAN (122)
  • 24% ASIAN
  • 18% AFRICAN AMERICAN (51)
  • 12% HISPANIC (34)
  • 1% INDIAN
FACTORS THAT IMPACT THE NORMATIVE DATABASE

AGE
- SOFTWARE DOES COMPARE AGE TO AGE FOR RFNL EVAL
- SOFTWARE DOES NOT COMPARE BASED ON ETHNIC GROUP

DISC SIZE
- DISC AREA 1.06 - 3.38 mm² (avg 1.38)
  - SMALL < 1.63 VS MEDIUM 1.63-1.97 VS LARGE > 1.97
- SOFTWARE DOES NOT COMPARE DISC SIZE FOR RNFL
- SOFTWARE DOES COMPARE DISC SIZE FOR ONH
  - SMALL OR LARGE DISC AREA NOT COMPARED DUE TO TOO FEW

CIRRUS ONH ANALYSIS

RIM AREA
- RANGE 0.75-2.38 mm² (AVG 1.31)
  - COMPARED TO Normals?
    - PEOPLE HAVE DIFFERENT AMOUNT OF GANGLION CELLS (700K-1.5 MILLION)
    - NO WAY TO ACCOUNT FOR THIS OTHER THAN TO AVERAGE THE VALUES

DISC AREA
- ALWAYS GRAY
  - LARGER DA WILL HAVE LARGER C/D AND MORE NEURO RIM TISSUE
    - 1.06-3.38 mm² (AVG 1.83)
    - SMALL <1.63
    - MEDIUM 1.63-1.9
    - LARGE > 1.97

CIRRUS ONH ANALYSIS

C/D RATIO
- DEPENDENT ON DISC AREA
- NUMBER OF GANGLION CELL AXONS IN RETINA
- INCREASES AS GANGLION CELL AXONS ARE LOST
  - VERTICAL MORE IMPORTANT

CUP VOLUME
- INCREASES AS EXCAVATION INCREASES
  - POORER REPRODUCIBILITY

CIRRUS RNFL ANALYSIS

AVERAGE RNFL THICKNESS
- THICKNESS OF GANGLION CELL AXONS
  - IT DOES INCLUDE
    - BLOOD VESSELS, ASTROCYTES, GLIAL CELLS
• Is a global index
  • Will miss focal damage
  • Look for asymmetry

• RNFL symmetry
  • Compares the entire TSNIT of the RNFL between R/L eyes

CIRRUS RNFL ANALYSIS

• RNFL thickness map
  • Reminiscent of GDX
    • Not as detailed, more blurry
  • Topographical display of the RNFL
  • An hourglass pattern
    • Thicker superior and inferior
    • Red/Yellow = thicker
    • Blue as RNFL thins/decreases

CIRRUS RNFL ANALYSIS

• RNFL deviation map
  • Boundaries of the cup and disc are plotted
    • Too small to be of use?
  • RNFL deviations from normal are plotted
    • Yellow < 5% of normals
    • Red < 1% of normals

CIRRUS ONH/RNFL symmetry analysis

• Neuro-retinal rim thickness symmetry
  • Compared to normative database
    • Look for asymmetry

• RNFL thickness symmetry
  • Compared to normative database
    • Look for asymmetry

CIRRUS RNFL ANALYSIS

• Quadrants
  • Compared to normative database
    • Look for asymmetry

• Clock hours
  • Compared to normative database
    • Look for asymmetry

So…what constitutes a glaucomatous RNFL on the OCT?

• Average?
• Quadrants?
• CLOCK HOURS?
• ASYMMETRY?
• OTHER?
• THAT IS SUBJECT TO DEBATE

MY GUIDE FOR SUSPECTING GLAUCOMA USING THE CIRRUS OCT FOR THE RNFL
Average thickness outside 95% CI (yellow <5% or red <1%)
OR
1 quadrant (sup / inf) outside 95% CI (yellow <5% or red <1%)
OR
2 clock hours (not directly temporal, nothing nasally) outside 95% CI (yellow <5% or red <1%)
OR
Asymmetry between the 2 eyes’ average thickness of > 9 um

Information can be loosely applied to Spectralis
2 clock hours =1 Spectralis segment

NOT SO FAST
Remember, each patient is different.

Also need to be aware of the following:
Asymmetry of Quads / Asymmetry of Clock / Thickness Map / Deviation Map / RNFL Thickness Plot

Results should correlate with the:
clinical ONH exam, clinical RNFL exam and VF exam

WHAT CONSTITUTES A GLAUCOMATOUS ONH ON THE OCT?

• RIM AREA?

• DISC AREA?

• AVERAGE C/D RATIO?

• VERTICAL C/D RATIO?

• CUP VOLUME?

• GUIDE FOR SUSPECTING GLAUCOMA USING THE CIRRUS OCT FOR ONH
Abnormal Optic Nerve Rim Area
OR
Abnormal Vertical C/D Ratio

Remember, each patient is different.

Also need to be aware of the following: OCT RETINAL NERVE FIBER LAYER

Results should correlate with the clinical ONH exam, clinical RNFL exam and VF exam

DO THE GUIDES ALWAYS WORK?

• NOT ALWAYS
  • USE THE INFORMATION COMPILLED FROM THE LITERATURE AS A GENERAL GUIDE
  • NO ONE METHOD WILL DIAGNOSE EVERY PATIENT
  • YOUR DEVICE MAY BE SLIGHTLY DIFFERENT
  • DO NOT COMPARE DATA ACROSS DEVICES
  • COMPARE TO CLINICAL ONH, CLINICAL NFL, VISUAL FIELD

MONITOR OCT FOR CHANGE
REGARDLESS OF WHAT YOU THINK OF THE NORMATIVE DATABASE

PERFECT OR IMPERFECT

ONCE THE PATIENT HAS HAD A BASELINE TEST

THE PATIENT CAN BE MONITORED FOR CHANGE FROM BASELINE

CIRRUS: GUIDED PROGRESSION ANALYSIS (GPA)

SPECTRALIS: TREND REPORT

OTHER THINGS THAT INFLUENCE THE MEASURED RNFL

BLOOD VESSELS

ASTROCYTES

GLIAL CELLS

THERE IS A FLOOR (APPROXIMATELY 50 um) AT WHICH ADDITIONAL MEASUREMENT IS NOT NECESSARY

INSURANCE COMPANIES MAY NOT PAY / REIMBURSE FOR RNFL MEASUREMENTS IN ADVANCED GLAUCOMA

FOLLOW WITH VISUAL FIELDS

STRUCTURAL LOSS

3 AREAS IMPACTED

OPTIC NERVE

• VISUALIZED

• MEASURABLE

NERVE FIBER LAYER

• VISUALIZED

• MEASURABLE

GANGLION CELLS

• NOT VISUALIZED

• MEASURABLE

RETINAL GANGLION CELLS

GLAUCOMA AFFECTS THE GANGLION CELL COMPLEX (GCC)

RNFL

• AXONS OF GANGLION CELLS

GANGLION CELL LAYER

• CELL BODIES

INNER PLEXIFORM LAYER

• DENDRITES

RETINAL GANGLION CELLS

700K-1.5 MILLION RETINAL GANGLION CELLS

50% LOCATED WITHIN 4.5 mm OF THE FOVEA

LESS VARIABILITY AMONG NORMAL INDIVIDUALS THAN ONH AND RNFL

EASY TO MEASURE?
JUSTIFICATION FOR IMAGING THE GANGLION CELLS

- SINCE A LARGE PROPORTION OF RGCS RESIDE IN THE MACULA, LOSS MIGHT BE A SIGN OF GLAUCOMATOUS DAMAGE

MACULAR VOLUME

- NORMALS > SUSPECTS > EARLY GLAUCOMA > ADVANCED

CORRELATION BETWEEN MACULAR THICKNESS AND VF MEAN DEVIATION


MACULAR THICKNESS CORRELATE WITH PERIPAPILLARY RNFL MEASUREMENTS


WHAT'S THE LATEST?

- 2014 JAPANESE STUDY
  - USING THE TOPCON 3D OCT 2000
  - 264 EYES
    - 64 HEALTHY EYES, 68 PREPERIMETRIC, 72 EARLY GLAUCOMA
  - RETINAL GANGLION CELL COMPLEX MEASUREMENT IS AS ACCURATE AS CIRCUMPAPILLARY RNFL MEASUREMENT
  - GCC EVAL MAY BE USEFUL IN
    - LARGE OR SMALL DISC
    - PERIPAPILLARY ATROPHY
    - TILTED DISC

CAN MY OCT DO THAT?

- FROM PREVIOUS ARTICLE
  - ALSO THE TOPCON 3D OCT 2000

- OTHERS?

- DIFFERENCES EXIST BASED ON WHAT IS ACTUALLY BEING SCANNED
  - ENTIRE MACULA THICKNESS
  - GCC
    - RNFL / GC / IPL
  - GC / IPL

- WHICH IS BEST?
  - THAT DEPENDS ON THE STUDY

GUIDE FOR SUSPECTING GLAUCOMA USING THE CIRRUS OCT FOR GCC

- AREAS OF INTEREST
  - MINIMUM
    - BEST PERFORMANCE (2013 study)
  - INFEROTEMPORAL
    - BEST PERFORMANCE (2012 study)

- RESULTS NOT APPLICABLE TO PATIENTS WITH CONCURRENT MACULAR DISEASE
  - AMD, CSME, CME, ETC.

- NO ONE TEST IS SUFFICIENT FOR ALL PATIENTS
  - NEED ONH, RNFL AND GCC

SPECTRALIS OCT FOR GCC
61 LINES, CENTRAL 20 DEGREES
• 6x6 mm SCAN
  • EQUIVALENT TO 10 DEGREE VF
• 8X8 GRID REPORT
• NO NORMATIVE DATABASE
  • ONE IS COMING
• COMPARISON
  • PATIENT SUPERIOR TO INFERIOR
  • PATIENT RIGHT TO LEFT
• ANOTHER STUDY
  • HIGH DIAGNOSTIC SENSITIVITY (83.3%) AND SPECIFICITY (92.6%) WHEN USING 3 CONSECUTIVE BLACK CELLS TO DETECT GLAUCOMA

SUMMARY
• A. Localized RNFL defect seen on Cirrus and Stratus circular diagrams, also on deviation from normal map and TSNIT graph
  • What I would call: An accurate OCT

• B. Localized RNFL defect not seen on Cirrus or Stratus or TSNIT graph but seen on deviation from normal map
  • What I would call: Green Disease

• C. Normal eye showing defects on deviation from normal map. True Subclinical RNFL loss or False Positives
  • What I would call: Red Disease

QUESTION: WHICH IS MORE DANGEROUS, RED OR GREEN DISEASE?

GREEN DISEASE
• ANOTHER WAY OF SAYING PREPERIMETRIC GLAUCOMA
  • THE PATIENT IS WORTHY OF ANOTHER LOOK, A CLOSER LOOK
• REMEMBER EACH PATIENT IS DIFFERENT
  • DAMAGE OCCURS AT DIFFERENT LOCATIONS IN DIFFERENT PEOPLE
• YOU HAVE THE RESPONSIBILITY TO CHECK EVERYTHING
  • CLINICAL: ONH, RNFL, VF
  • OCT
    • RNFL
      • AVG, QUADS, SECTORS, COMPARISONS, DEVIATION MAP, ETC.
    • ONH
      • RIM AREA, C/D VERTICAL
    • GCC
• HOW EARLY SHOULD WE INITIATE TREATMENT?