

Screening:  
Can OCT Imaging be Used to Differentiate  
Normal from Glaucomatous Eyes in the General  
Population?

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- I have no financial interests or relationships to disclose

# Screening

## ■ Definition

- ◆ A strategy used in a population to identify an unrecognized disease in individuals without signs or symptoms

## ■ Goal

- ◆ Treat disease in its early stages
- ◆ Reduce disease morbidity or mortality of disease
- ◆ Preserve function and quality of life

# Wilson's Criteria for Mass Screening

1. Disease should be common and serious  
Prevalence affects predictive value
2. Screening test should be highly accurate  
Sensitivity, specificity, false negative, false positive, likelihood ratio
3. Natural history should be understood  
Should have a long preclinical phase
4. Acceptable treatment and resources for treatment should be available  
Benefit of early treatment outweighs costs of screening
5. Treatment should favorably influence outcome

# Sensitivity, Specificity and Positive Predictive Value

- **Sensitivity (SE)** = probability of correctly identifying a true case
  - ◆ **False negative rate** =  $1 - SE$
- **Specificity (SP)** = probability of correctly identifying a true non-case
  - ◆ **False positive rate** =  $1 - SP$
- **Positive Predictive Value (PV)** = Probability that a labeled positive is a true case

# Sensitivity and Specificity

- Optimal SE and SP depends on relative costs of FPs and FNs
  - ◆ More severe disease, minimize FNs
    - ◆ Maximize SE
  - ◆ Economic costs of subsequent exams or psychosocial consequences of label, minimize FPs
    - ◆ Maximize SP

# Positive Predictive Value

- Predictive value depends on test validity (SE and SP)  
PLUS frequency of disease in screened population
- $PPV = TP \div (TP + FP) = SE(P) \div (SE(P) + (1-SP)(1-P))$   
P= Disease prevalence

For a screening test with a given SE and SP, the rarer the disease, the lower the PPV

# Issues about Screening

- SE and SP reflect validity of a screening test
- PPV reflects relative cost efficiency of a screening program



# PBA Glaucoma Advisory Board Recommendations Regarding Screening

For moderate to severe disease = optic neuropathy with visual  
field loss

- ◆ 85% sensitivity
- ◆ 95% specificity although 98% preferable

Stamper RL. Glaucoma Screening [Review]. J Glaucoma, 1998;7:149-50.

# AHRQ Screening For Glaucoma: Comparative Effectiveness

- April 2012

**Performance of time-domain and spectral-domain Optical Coherence Tomography for glaucoma screening**

Boel Bengtsson, Sabina Andersson and Anders Heijl

# Screening with TD-OCT and SD-OCT

- Study by Bengtsson et al. in 2012
  - ◆ To investigate the measures of validity for selective or population screening
- Study population
  - ◆ 170 subjects of a random sample of 307 from 4718 subjects >50 years
    - ◆ (Participation =55%)
  - ◆ 138 subjects of a random sample of 394 clinical glaucoma patients
    - ◆ Inclusion criteria: glaucomatous disc changes
- Clinical Examinations
  - ◆ Complete eye examination, IOP, fundus exam
  - ◆ GDx scanning laser polarimetry
  - ◆ SAP and FDT perimetry
  - ◆ Stratus TD-OCT scan and Cirrus SD- OCT scan
    - ◆ RNFL thickness analyses for average thickness, quadrant and clock-hour sectors were compared with normative significance limits available in the instruments.

Performance of time-domain and spectral-domain Optical Coherence Tomography for glaucoma screening

Joel Bengtsson, Satim Anand, and Anders Heijl

# Screening with TD-OCT and SD-OCT

- Results with average RNFL thickness in population-based sample

	TD-OCT	SD-OCT
Sensitivity < 5%	0.78 (0.51-1.00)	0.89 (0.68-1.00)
Specificity < 5 %	0.99 (0.98-1.00)	0.95 ((0.92-0.99))
Sensitivity < 1%	0.67 (0.36-0.98)	0.67 (0.36-0.98)
Specificity < 1%	1.00 (1.00-1.00)	0.98 (0.95-1.00)

- Conclusion: TD – OCT better for screening because of high specificity and SD - OCT better for early detection because of high sensitivity

# Important Issues to Consider When Screening for Glaucoma in General Population

- ◆ High SE, SP, PPV
- ◆ Easily transportable
- ◆ Useable with standard wall outlet
- ◆ Rapid
- ◆ Few poor quality scans
- ◆ Inexpensive
- ◆ Easy to perform by lay persons or technicians
- ◆ Results easily interpretable