Use of Optical Coherence Tomography as a Diagnostic Tool for Suspected Multiple Sclerosis in a Tertiary Center

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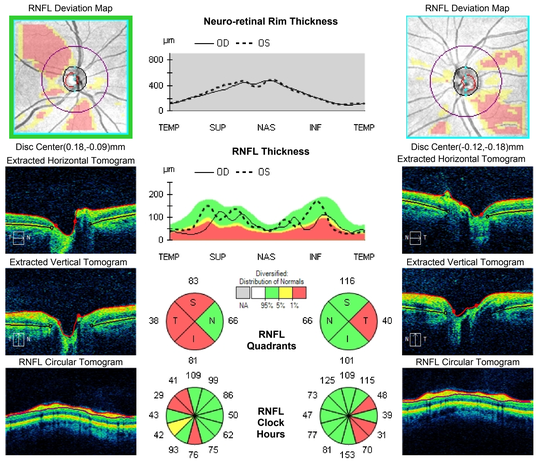
Background

- On post-mortem analysis, up to 99% of patients with multiple sclerosis (MS) are shown to have optic nerve demyelination and evidence for loss of retinal ganglion cells[1]
- Optical Coherence Tomography (OCT) is a non-invasive imaging technique used to indirectly estimate integrity of the optic nerve through evaluation of the retina
- OCT metrics such as retinal nerve fiber layer (RNFL) thickness have been shown to correlate with and predict levels of brain atrophy on MRI as well as clinical measures of disability in MS[3,4]
- One small study showed that average RNFL thickness on OCT predicted the development of MS in those with CIS[5]
- It is not clear how MS specialists, particularly those with ready access to OCT scans, are incorporating this imaging into the diagnosis and management of people with suspected or confirmed MS



Sample OCT scan showing images of peripapillary retinal nerve fiber layers for each eye. Schematic demonstrating RNFL quadrant thickness, with red and yellow indicating decreased thickness. The scan demonstrates a pattern of loss greatest in the temporal regions, often seen in MS.

Objective

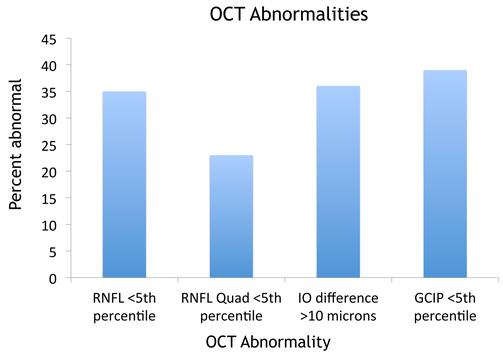
- This study sought to characterize the use of OCT in evaluation of new patients presenting with suspected MS at a tertiary care institution

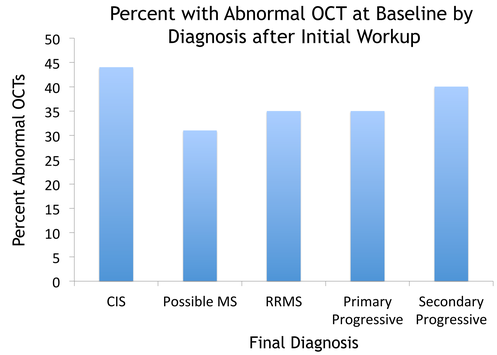
Methods

- A retrospective chart review was completed evaluating patients seen by an MS specialist for their first visit at the Johns Hopkins University MS Center between June 2013 and December 2015
- Patients who presented for evaluation of diseases other than MS, and patients identified as not having at least possible MS at the end of their presenting visit, were excluded from analyses.
- Detailed patient characteristics, results of OCT testing (if performed), and utilization patterns among MS providers were identified and recorded.
- Abnormal OCT results were defined as : RNFL thickness <5th percentile, RNFL in one or more quadrants <5th percentile, ganglion cell/inner plexiform (GCIP) layer thickness <5th percentile, or interocular difference of >10 microns
- Results were summarized and analyzed using descriptive statistics and logistic regression

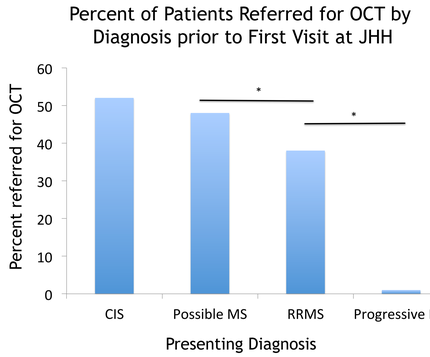
Results

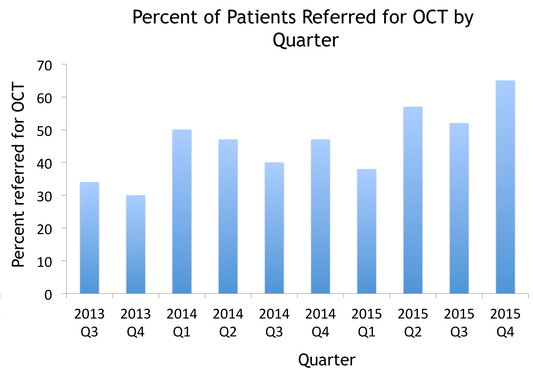
Characterizing OCT Abnormalities



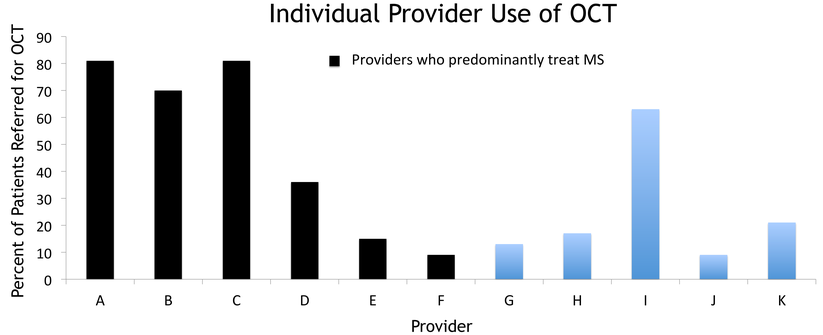


Overall Provider Use of OCT at a Tertiary Care Center





Individual Provider Use of OCT



Results

- **2,231** charts were evaluated; **1,286** were removed from analyses because the patient was not evaluated for possible MS, or because MS was not a diagnostic consideration at the end of the first consultation
- Of the **945** remaining patients, **412 (44.0%)** of patients were evaluated with OCT (**93%** female; mean age **46.7** years)
  - **142 (34.4%)** had abnormal OCT results (results missing for 32 as scans performed elsewhere/scans ordered but not completed).
    - ✓ **50 (35.2%)** had abnormal average retinal nerve fiber layer (RNFL) <5th percentile
    - ✓ **51 (36%)** had an interocular difference in RNFL > 10 microns
    - ✓ **32 (22.5%)** had RNFL in one or more quadrants <5th percentile
    - ✓ **56 (39.4%)** had GCIP layer thickness <5th percentile
  - The proportion of patients for whom an OCT was ordered differed across categories of presenting diagnosis (likelihood ratio test with 3 df P<0.001).
    - ✓ Patients presenting as possible MS patients were more likely to have an OCT ordered (OR: 1.57; 95% CI: 1.18 to 1.57; P=0.001)
    - ✓ Patients presenting with a diagnosis of progressive MS were less likely to have an OCT ordered (OR: 0.09; 95% CI: 0.01 to 0.65; P=0.01)
  - Percent of patients referred for clinical OCT rose between 2013 and 2015
  - Percent of patients referred for OCT ranged from **9-81%** depending on the provider (11 providers, 7 of whom primarily evaluate and treat MS)

Limitations

- Detailed ophthalmologic history is not available for this population
- It remains unclear how patients <u>not</u> evaluated by OCT systematically differ from those evaluated (possible bias)
- Further clinical characterization is underway

Conclusions

- Many MS specialists order OCT in this tertiary care center with easy access to OCT as part of the evaluation of new patients, but use of OCT in evaluation of MS varies greatly between physicians
- While OCT is a measure of neurodegeneration, the underpinning of disability progression, specialists are much more likely to use OCT in relapsing MS, particularly for those with suspected MS or CIS. This suggests specialists may be using it largely as a diagnostic tool
- The proper role of OCT in the diagnostic evaluation of suspected MS, as well as its utility in monitoring the disease, remains to be determined; further, these indications may change with the development of new therapies targeting non-inflammatory disease processes

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