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OPTIMA
Ophthalmic Image Analysis

BG: Novartis, Bayer, Roche, Zeiss (C)
BG: DXS (F)
HB: Heidelberg Engineering, Apellis, RetInSight (F)
HB: Bayer, Apellis (R)
USE: Genentech, Kodiak, Novartis, Apellis, RetInSight (F)
USE: RetInSight (P)

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Protocol T-Retreatment based on CST and BCVA stability: can we do better considering intraretinal fluid volumes for disease stability?

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Purpose

To evaluate the impact of automatically segmented intraretinal fluid (IRF) volume measurements by a deep leaning algorithm[1] on potential retreatment decisions compared to the actual retreatment during the DRCR Retina Network (DRCR) Protocol T study which was based on CST and BCVA.

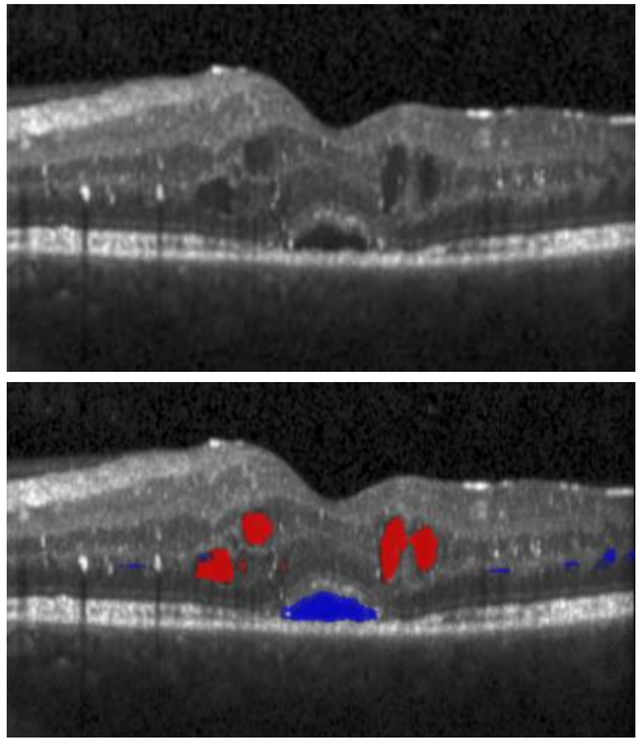


Figure 1: Example of IRF (and SRF) fluid volume segmentation of Vienna Fluid Monitor, adapted from[2] The upper image shows the original OCT scan, the lower image the same scan with fluid volume segmentations.

Methods

656 patients | 8160 visits | 6048 anti-VEGF treatments

Protocol T anti-VEGF retreatment criteria

- Central retinal thickness (CST) change of ≥10% OR
- Best-corrected visual acuity (BCVA) change of ≥5 ETDRS letters

…in comparison to last visit, otherwise considered "stable"

Stability criteria = no treatment

- 2 stable visits (without CST/BCVA change) and CST<250µm and BCVA≥20/20 or
- 2 stable visits (without CST/BCVA change) and CST≥250µm or BCVA≤20/20 after week 24 (in case of 2 stable visits and either CST or BCVA are not perfect, treatment is continued

Analysis of stable treatment visits with Fluid Monitor

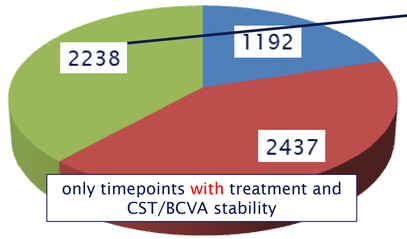
- IRF volume measurements by deep learning algorithm (RetInSight Fluid Monitor, Vienna, Austria)
- Calculations of fluctuations (= volume change from last visit)
- Fluctuations of ≥30nl in central 3mm IRF INSTABILITY
- Fluctuations of ≤10nl in central 3mm IRF STABILITY
- Fluctuations from >10nl to <30nl excluded

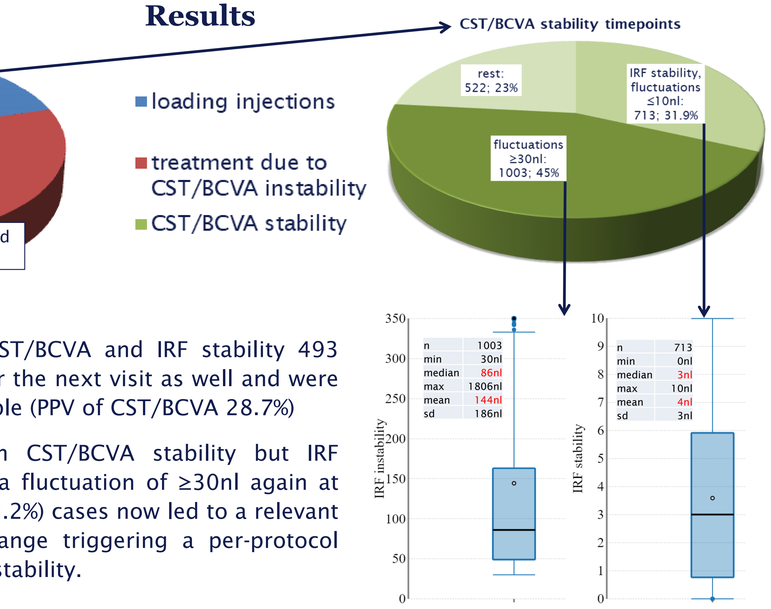
- Calculation of positive predictive value (PPV) of CST/BCVA stability for the IRF volume stability criterion.

- Amount of visits, when CST is stable but IRF fluctuations are seen AND the next visit received treatment (then due to CST/BCVA instability or imperfect outcome)

Disclaimer: The source of the data is the DRCR Retina Network but the analyses, content and conclusions presented herein are solely the responsibility of the authors and have not been reviewed or approved by the DRCR Retina Network.

Results





Out of the 713 visits with CST/BCVA and IRF stability 493 (69.1%) remained IRF stable for the next visit as well and were thus correctly classified as stable (PPV of CST/BCVA 28.7%)

Out of the 1003 visits with CST/BCVA stability but IRF instability, 671 (66.9%) show a fluctuation of ≥30nl again at the next visit, which in 357 (53.2%) cases now led to a relevant CST (228) or BCVA (192) change triggering a per-protocol treatment due to CST/BCVA instability.

Considering all timepoints with CST/BCVA stability (4026) with and without treatment, the ones that received treatment at the next visit (2229) had a mean prior IRF fluctuation of 69nl and no relevant CST change (-2µm), whereas the ones that had received no treatment (1797) at the next visit, had a mean prior IRF flucutation of 26nl and also no relevant CST change (0µm). IRF fluctuations grouped by treatment at the next visit show a significant difference between both groups (p<0.0001).

Conclusion

- Automatically quantified IRF can guide treatment in diabetic macular edema
- Guidance by IRF can detect anatomic instability earlier than BCVA/CST
- This can prevent inadequate treatment pausing in case of fluctuations not mirrored in CST
- Improvements in visual outcomes can be the consequence in clinical routine as vision loss due to untreated IRF can be avoided
- Objective fluid monitoring tools are the future for objective retreatment guidance

References

[1]Schlegl T, Waldstein SM, Bogunovic H, Endstraßer F, Sadeghipour A, Philip AM, Podkowinski D, Gerendas BS, Langs G, Schmidt-Erfurth U. Fully Automated Detection and Quantification of Macular Fluid in OCT Using Deep Learning. Ophthalmology, 2018 Apr;125(4):549-558. doi: 10.1016/j.ophtha.2017.10.031. Epub 2017 Dec 8. PMID: 29224926.

[2]Gerendas BS, Bogunovic H, Sadeghipour A, Schlegl T, Langs G, Waldstein SM, Schmidt-Erfurth U. Computational image analysis for prognosis determination in DME. Vision Res. 2017 Oct;139:204-210. doi: 10.1016/j.visres.2017.03.008. Epub 2017 May 9. PMID: 28433753.