More is Better: Wide-Field Fluorescein Angiography

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Historical Perspective

1926: first reliable 20° fundus camera

1961: fluorescein angiography developed

1970s: rudimentary wide-field camera with scleral transillumination and contact lens

1980s:
- peripheral sweeps, creating montage (pioneered with ETDRS 7 standard fields (7SF))
- scanning laser ophthalmoscope (SLO) technology

1990s
- specialized contact lenses and non-contact lenses for up to ~100° field of view
7SF and Montage

Approximately 75°

Limitations

- patient alignment problems
- focus irregularities
- marginal corneal astigmatism
- poor fixation
- light reflex artifacts
- error of image alignment with montage creation
Red, Green and Blue Scanning Lasers

VITREOUS
RETINA
RPE
CHOROID
SCLERA

633nm
532nm

488nm
Current Technology

Using a special lens adapter with small-angle camera

Dedicated wide-angle camera
Current Technology

Image renderings

Fluorescein angiography

ICG

Fundus Autofluorescence
Current Technology

RetCam

• Utilizes contact lens system with coaxial illumination
• Provides $130^\circ$ field of view
• Best suited for neonates and infants
• Being used in ROP telemedicine programs
Current Technology

Heidelberg Spectralis
- $55^\circ$ or up to $150^\circ$ field of view
- Capable of FA, ICG, FAF
Current Technology

Optos OptoMap
- 200° field of view w/ non-contact lens
- Capable of FA, ICG, FAF
Role of Wide-Field Angiography

Dynamic with true temporal reference imaging

Better visualization of peripheral pathology

Peripheral pathology might play an even more significant role in the pathophysiology and management of retinal disease

Document peripheral findings and response to treatment
Role of Wide-Field Angiography

Retinal Vascular Disease – Diabetic Retinopathy, Retinal Vascular Occlusions,
- neovascularization
- macular edema

Posterior Uveitis
- Vasculitis
- Choroiditis or Retinitis

Pediatric Retinal Disease
- Hereditary Retinal Disease
- ROP
Diabetic Retinopathy

Studies regarding PRP are >30 yrs ago
WFI shows 2x amount of nonperfusion and neovascularization than 7SF
10-15% of eyes, WFI shows nonperfusion and neovascularization that 7SF misses
DME

Mixed mechanism etiology
- localized vascular leakage
- inflammation
- vitreoretinal traction
- localized macular ischemia
- diffuse retinal ischemia
Diabetic Retinopathy

Correlation between amount of peripheral nonperfusion and DME
- role of peripheral laser in managing recalcitrant DME
- RaSCAL trial

Peripheral perivascular leakage associated with n.v. and DME
Diabetic Retinopathy

Targeted Retinal Photocoagulation (TRP) for PDR
- laser to areas of capillary non-perfusion seen on WFI
- decreases side effects (peripheral visual field defects, decreased night vision, etc)

Earlier PRP?
- quantifying extent of peripheral ischemia

How much PRP is enough?
- monitoring treatment response and disease progression
Retinal Venous Occlusions

More accurate classification of ischemic vs non-ischemic
Visualize peripheral nonperfusion, vascular leakage or n.v. otherwise missed by traditional imaging
• ischemic index: area of nonperfusion / area of visualized retina
Retinal Venous Occlusions

TRP for patients with macular edema refractory to anti-VEGF or steroids
Peripheral Retinal Vascular Disease

Sickle Cell Disease
- Improved screening
- Monitor increasing nonperfusion
- Earlier detection of neovascularization prior to vitreous hemorrhage or traction

Coats Disease
Retinopathy of Prematurity

Good correlation between RetCam images and indirect ophthalmoscopy

Telemedicine for ROP

Documentation of findings
Pediatric Retinal Diseases
Pediatric Retinal Diseases
Limitations

Peripheral aberrations
- 3-D structure on 2-D image

SLO “color” image
- Rendering from 2 wavelength lasers
- Not same quality as traditional light based images

Contact lenses
- Learning curve
- Corneal irritation/abrasions

Entire area of retina not imaged
- Does not replace indirect ophthalmoscopy with scleral depression
Future Directions

Research on effects of peripheral ischemia on posterior disease
  • improved treatment paradigms

Telemedicine protocols

Prospective trials for TRP

Race to get to the ora
References


