**Diabetic Retinopathy - Perspective**

- One of the top 4 causes of blindness (USA)
- Risk is related to duration and degree of hyperglycemia
- 20 years following diagnosis (<30 years of age) nearly all have some retinopathy

**Definition of DR and clinical features**

- Progressive dysfunction of the retinal vasculature caused by chronic hyperglycemia.
- This results in leakage from the retinal vascular tree with deposition of exudate, bleeding, fluid accumulation in the inner retina, intraretinal hemorrhage; and ischemic changes (cotton wool spots, collateral vascular channels) that can lead to abnormal vascular appearances, vascular proliferation, vitreous hemorrhage, vascular remodeling, traction retinal detachment and blindness.

**Statistical Overview (CDC, 2007*)**

- Nearly 25 million people – almost 8% (2007, USA; latest CDC #s) (up from 18 million / 6.2% in 2004)
  - Of the 25 million, 6 million undiagnosed
  - Up to 41 million with prediabetes!
- 10% with Type 1 diabetes
- One in every 500 children/adolescents
- Leading cause of severe vision loss in the working age population


**Clinical features (in a nutshell)**

<table>
<thead>
<tr>
<th>Retinal</th>
<th>Retinal / other ophthalmic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microaneurysms</td>
<td>Vitreous hemorrhage</td>
</tr>
<tr>
<td>Retinal hemorrhages</td>
<td>Retinal detachment</td>
</tr>
<tr>
<td>Retinal lipid exudates</td>
<td>Neovascular glaucoma</td>
</tr>
<tr>
<td>Cotton-wool spots</td>
<td>Premature cataract</td>
</tr>
<tr>
<td>Capillary nonperfusion</td>
<td>Cranial nerve palsies</td>
</tr>
<tr>
<td>Macular edema</td>
<td></td>
</tr>
</tbody>
</table>
Diabetes

- Nationwide there has been a significant increase in the incidence of diabetes during the last decade.
- This increase was seen across all regions, demographic groups, ages, genders, racial/ethnic groups and subpopulations.
- 800,000 new cases every year.

DM by Age

- Age 20 years or older: 23.5 million or 10.7% of all people in this age group have diabetes.
- Age 60 years or older: 12.2 million or 23.1% of all people in this age group have diabetes.

Estimated number of new cases of diagnosed diabetes in people aged 20 years or older, by age group—United States, 2007.

Source: https://www.cdc.gov/diabetes/pubs/estimates07.htm#fig3.

Trials of Diabetic Retinopathy

- The Future – Emerging Trends

- Diabetic Retinopathy Clinical Research Network (DRCRN)
- International Classification of DR
- Increased use of technology
- Increased patient self-management/self care of diabetes
- Stem cell research

A Cure

The lexicon

Lesions in DR

- VCAB - venous caliber abnormalities
- H/Ma - hemorrhages and microaneurysms
- IRMA - intraretinal microvascular abnormalities
- SE - cotton wool spots / soft exudates
- HE - hard exudates
- CSME - clinically significant macular edema
- DME - diabetic macular edema
The lexicon (con’t)

• NVD - neovascularization of the disc
• NVE - neovascularization elsewhere
• VH - vitreous hemorrhage
• FP - fibrous proliferation
• HRC – high-risk characteristics
• PRH - preretinal hemorrhage
• A1C – glycated hemoglobin (GHb, GHbA1c)
• Nonperfusion of the retina

Epidemiology

• Severity closely correlates with duration of disease
• For Type I diabetes, diabetic retinopathy is present in
  • 27% of those who have had diabetes for 5–10 years
  • 71–90% of those who have had diabetes for >10 years
  • 95% after 20–30 years
  • ~30–50% of these patients have proliferative diabetic retinopathy (PDR)

Diabetic Retinopathy - Perspective

• Among those > 30 years, lower risk but fundus signs may be the first indicator of the disease
• Retinopathy and insulin dependence
  • 80/20 IDDM/NIDDM - % retinopathy (>30 yrs.)
  • For PDR: 40/5
  • CSME: 10-15% after 15-20 years duration regardless of insulin status
• 50% of patients with PDR will become blind <= 5 years following diagnosis without treatment

\[ A_1C \text{ and blood glucose} \]

<table>
<thead>
<tr>
<th>HbA1c (%)</th>
<th>mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>133</td>
</tr>
<tr>
<td>7</td>
<td>170</td>
</tr>
<tr>
<td>8</td>
<td>205</td>
</tr>
<tr>
<td>9</td>
<td>240</td>
</tr>
<tr>
<td>10</td>
<td>275</td>
</tr>
<tr>
<td>11</td>
<td>310</td>
</tr>
<tr>
<td>12</td>
<td>345</td>
</tr>
</tbody>
</table>

Convenient conversion formula: \([(HbA1c \times 10) + 10] \times 2 = \text{“BS”}\]

Staging NPDR

• 33 B/F, 24 wks pregnant
• History of gestational diabetes (first episode X 15 years)
• Meds: glucotrol, glucophage, insulin X 1 mo;
• BS: 95-130, 95 this AM; A1C unknown
• BCVA (CL); 20/20, 20/20-
• Ant seg unremarkable, T: 17/18
• DFE: …
Mild NPDR – OD

OD
Mild NPDR

Moderate NPDR – OS

OS
Ring of exudate > 1/3 DD from mac.
Dx: Moderate NPDR

Mild / Moderate NPDR

Summary
- OD: scattered hemorrhages w/o retinal thickening, CSME, nor NV(D or E)
- OS: scattered hemorrhages w/o CSME, nor NV(D or E)
  - exudate with thickening superior to macula w/ 2 dot hemorrhages temporal to macula

Assessment / Plan
(Gestational Diabetes)
- Mild /Moderate NPDR OD/OS
- Document with digital images and drawings
  - Monitor X 3mo.

Retinal Capillary Circulation comparison

Normal
Diabetic - microaneurysm

Clinically Significant Macular Edema
**Other Vascular Changes**

**Venous loops / vessel reduplication**

*Localized vessel narrowing*


**Diabetic Retinopathy – Clinical Continuum**

- Formation of retinal capillary microaneurysms
- Development of excessive vascular permeability
- Vascular occlusion
- Proliferation of new blood vessels + sequelae (fibrous/new vascular tissue at the ONH w/ subsequent contraction)

**Staging Diabetic Retinopathy**

- Nonproliferative Diabetic Retinopathy (NPDR)
  - Mild
  - Moderate
  - Severe
  - Very Severe
- Proliferative Diabetic Retinopathy (PDR)
  - Mild
  - Moderate
  - High-risk
- CSME

**Resource for Standard Photos**

http://eyephoto.ophth.wisc.edu/ResearchAreas/Diabetes/DiabStds.htm

**Mild NPDR**

- At least 1 MA
- One or more of the following
  - Retinal hemorrhages
  - Hard exudates
  - Soft “exudates”
- Standard 1 “H & MA”
Moderate NPDR
- H & MA > standard photo 2A
  - Hard or Soft exudates
  - Venous Beading
  - IRMA evident
  (Intraretinal Microvascular Abnormalities = “detours”)

Note: 2A would represent an example of very severe NPDR if this were the presentation in all 4 quadrants.

Severe NPDR (4/2/1)
- One or more of the following
  - H & MA > (2A) 4 quadrants
  - VB > 2 quadrants (6B)
  - IRMA > (8A) in at least 1 quadrant

Very Severe NPDR
- Two or more of the following
  - H & E > standard photo 2A in all 4 quadrants
  - VB definitely present in > 2 quadrants (e.g., Standard photograph 6B)
  - IRMA > standard photo 8A in at least 1 quadrant
Proposed international DR disease severity scale (alternative classification)

<table>
<thead>
<tr>
<th>Proposed Disease Severity Level</th>
<th>Finding Observable on Dilated Ophthalmoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No apparent retinopathy</td>
<td>No abnormalities</td>
</tr>
<tr>
<td>Mild nonproliferative diabetic retinopathy</td>
<td>Microaneurysms only</td>
</tr>
<tr>
<td>Moderate nonproliferative diabetic retinopathy</td>
<td>More than just microaneurysms but less than severe nonproliferative diabetic retinopathy</td>
</tr>
<tr>
<td>Severe nonproliferative diabetic retinopathy</td>
<td>Any of the following: more than 10 intraretinal hemorrhages in each of 4 quadrants, definite venous beading in 2+ quadrants, microaneurysm absence in 1+ quadrants, and signs of proliferative retinopathy</td>
</tr>
<tr>
<td>Proliferative diabetic retinopathy</td>
<td>One or more of the following: neovascularization, vitreous/retinal hemorrhage</td>
</tr>
</tbody>
</table>


Diabetic Retinopathy Continuum – All Roads Lead to ME – the greatest cause of vision loss in diabetics

Clinically Significant Macular Edema (CSME)

CSME definitions

- Thickening of the retina ≤ 500 microns (1/3 DD) from the center of the macula
- H/E with thickening of the adjacent retina ≤ 500 microns (1/3 DD) from the center of the macula
- Any zone of retinal thickening > 1 DA in size ≤ 1 DD from the center of the macula

How is macular edema detected?

- At slit-lamp with stereo observation
- Thickening
- Inner retinal opacification
- Separation of inner retina from RPE
- OCT / CSLO
- FA

Clinically Significant Macular Edema

Diabetic Retinopathy – Macular Edema Summary

- Retinal thickening = fluid accumulation
- Best visualized CLINICALLY at stereoscopic slit-lamp examination
- A clue to presence is exudates (lipid deposits) at the border of the edema
- Edema is transient but exudates beneath the fovea are associated with permanent vision loss
Why worry about CSME?

- Leading cause of vision loss in diabetic patients
- Regardless of insulin-dependence status
- Regardless of type
- Regardless of duration


Mild NPDR

- 38 BF
- DM X 10 years; BS: 100’s – 300’s
- History of PDR w/PRP laser ’99
- BCVA 20/20- / 20/20-; - Amsler
- DFE . . .

Mild NPDR W/O Macular Thickening

OD
H,E w/o thickening
- CSME, - NV

OS
H, - CSME, - NV

Mild NPDR

- 38 BF
- Assessment and Plan
  - OD: H,E w/o thickening or CSME, - NV
  - OS: H, - CSME, - NV
  - Recheck 4 mo

Diabetic Retinopathy
- Management Guidelines

- MILD NPDR
  - Without CSME: <= annual evaluation
  - In the presence of CSME: consider focal laser
  [need FA first]
  - W/ macular edema: document, follow 4-6 mo.
Diabetic Retinopathy - Management Guidelines

- Moderate NPDR
  - W/O macular edema: document and evaluate X 6 mo.
  - W/ macular edema: document, RTC X 4 mo.
  - W/ CSME: document, FA, consider focal laser, evaluate X 2-4 mo.

- Severe NPDR
  - W/O macular edema: document, follow 3 mo.
  - W/ macular edema: document; consider FA, laser; follow 2-3 mo.

- CSME – a significant risk for vision loss
  - Document, FA, focal laser, follow 2-3 mo.

- MILD NPDR
  - Without CSME: annual evaluation
    - In the presence of CSME
      - consider focal laser
      - intravitreal triamcinolone
      - especially if reduced VA
  - W/ macular edema: document, follow 4-6 mo.

Diagnosing CSME

- Direct observation (SL)
- Digital techniques (“cheating”)
  - OCT – meridional X-sections (10 µ, 2.5 sec)
  - HRT – thickness measure (localization, average; 1.6 sec)
  - RTA – 6.6º square area .25 sec

Optical Coherence Tomography

Confocal Scanning Laser Retinal Topography (HRT)

- Uses a confocal scanning laser ophthalmoscope (CSLO) for acquisition and analysis of three-dimensional images of the posterior segment of the eye.

CSLO

- A two-dimensional confocal image is formed. It may be regarded as an optic section at any given focal plane.

Topography Image, Normal Retina

- Measurement of the maximum location of the confocal intensity profile at each image point \((x,y)\) results in the topography image. The topography image is color coded (light color: deep, dark color: high).

Signal Width Map: Normal Retina

- In a normal eye, the signal width is smallest at the fovea. It increases with increasing distance from the fovea.
Signal Width Map: DME

- If a macular edema is present, the thickness of the retina is largely increased, and the signal width map shows wider signals (lighter colors) at the site of the edema.

CSME - Intravitreal Triamcinolone

(4 mg Single Injection)

NPDR S/P 3 focal lasers
Diffuse leak @ FA
OCT: persistent ME W/large cystic space VA 20/50

CSME - Intravitreal Triamcinolone

Persistent ME/cystoid space VA 20/200
S/P 1 mo intravitreal triamcinolone VA 20/60
S/P 3 mo intravitreal triamcinolone VA 20/50

Vitrectomy for CSME

- PP vitrectomy results (65 eyes)
  - 48 with previous laser tx.
  - BCVA improved > 2 lines in 32/65 (49%)
  - BCVA was unchanged in 29/65 (45%)
  - 4 eyes developed NV or CSME
  - Retinal thickness: 464 → 225
  - Example...

Vitrectomy and DME

- Foveal attachment following PVD may aggravate blood-retinal barrier breakdown
  - 49 eyes with DME
    - Stage 0 / Prevalence (%)
      - DME 38.8
      - Stage 1 / 53.0%
      - Stage 2 / 2.0%
      - Stage 3 / 5.3%
  - Controls (35 age/sex matched controls)
    - Stage 0 / 69.4
    - Stage 1 / 22.4
    - Stage 2 / 2.0
    - Stage 3 / 6.2


70 YO male

Pre-op [logMAR 0.5] 6 days Post-op [logMAR 0.8]

1 mo. [logMAR 0.5] 4 mo. [logMAR 0.7]

Diabetic Retinopathy Management Alternatives

- Focal laser
- Intravitreal triamcinolone
- Vitrectomy
- Octreotide
- Protein kinase C inhibitors
- Aldose reductase
- Anti-oxidants
- Blood rheology

Microaneurysms

- Pathognomonic of diabetic retinopathy!!!
- Total # is directly related to risk of progression
- Increased vascular permeability is a risk for macular edema
- Their presence with or without edema is classified as Mild NPDR

Mild NPDR – Behind the Scenes

Microaneurysms / thickening above macula (< 500 µ) w/ exudates

Mild NPDR

Juxtaposed to show 2 clumps of moderately large µ-aneurysms that were not as evident clinically

Mild NPDR

Late phase FA showing leakage from the clumps of microaneurysms
Diabetic Retinopathy – IRMA

- Vaso-obliteration process
  - acellular capillaries become confluent
  - or terminal arterioles become obliterated
- These may be new vessels or collaterals (existing vessels now dilated)
- Distinguish from neovascularization (finer vessels)

IRMA - Moderate NPDR

- With progressive capillary closure, intraretinal hemorrhages and venous beading develop
- Severity and extent of microaneurysms, hemorrhages, and venous beading defines moderate to severe NPDR

Diabetic Retinopathy – Proliferative Diabetic Retinopathy (PDR)

- Neovascularization at or within one DD of the ONH
  - At high risk for blindness w/o Tx.
    - 50% w/in 5 years of onset
  - Course is variable (weeks to years)

PDR – Diagnostic Criteria

- Mild
  - Neovascularization elsewhere (i.e., not at the disc) [NVE]
  - Fibrous proliferation at the disc (FPD) or FPE W/O NV

PDR - Diagnostic Criteria

- Moderate
  - NVE elevated
  - Significant NVE (> ¼ DA)
  - Vitreous (VH) or pre-retinal (PRH) hemorrhage and NVE (<1/2 DA); W/O NVD
PDR - Diagnostic Criteria & Prognosis

- High Risk PDR (based on size and hemorrhage)
  - NVD >/= 1/4 - 1/3 DA
  - NVD and VH/PRH (pre-retinal heme)
  - NVE >/= 1/2 DA and VH / PRH

- Severe vision loss or vitrectomy (SVLV) *
  - Strongest indicator is high-risk PDR
  - Other indicators of SVLV include: decreased VA at baseline, CSME, older age (Type II diabetes)

* Davis et al. ETDRS # 18. IVOS 1998; 39: 233-52

PDR Continuum

- Proliferation to regression
- New vessels grow and are surrounded by fibrovascular tissue that adheres to posterior vitreous
- Contraction of the vitreous can result in hemorrhage and/or traction RD

- PVD lowers risk for progression of vessel growth

Standard Photo 10A

High Risk PDR
Case Study CL

Courtesy A. Cavallerano, OD, Boston, MA

Case Studies - Patient CL

- 47-year-old female
- Type 1 DM x 26 years
- LEE - 6 months ago (undilated)
- Dilated retinal examination 2 years ago
- POHx – “mild retinopathy”
- No ocular or visual complaints

VA = 20/20 OD, 20/30 OS
Sensorimotor examination intact
SLE – early cataract OD;
no evidence of NVI

Case CL OD

Mild/mod NPDR

What do you see here?
PDR < HRC

Let's look at the fellow eye
Case CL OS
Pretreatment
Mild/mod NPDR
PDR with HRC
PRH
Early DME
Diabetes Mellitus

**Clinical Pathologic Process in DR**
- Closure of retinal capillaries and arterioles
- Cotton-wool spots
- Breakdown of the blood/retinal barrier with increased vascular permeability of retinal capillaries
- Intraretinal microvascular abnormalities (IRMA) also found adjacent to areas of capillary closure
- 70% of NVE occurs in same area as IRMA
- Proliferation of new vessels and fibrous tissue
- Contraction of vitreous and fibrous proliferation with VH and RD

---

**Case CL post treatment**

- **NVD/NVE**
- **Preretinal hemorrhage**
- **Vitreous hemorrhage**
- **Angiogenic factors**
  - Vitreous serves as a reservoir for growth factors including
    - bFGF – fibroblast growth factors
    - IGF – insulin-like growth factor
    - VEGF – vascular endothelial growth factor

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**CL - Notes**
- **Points**
  - No ocular or visual complaints
  - Last eye exam 6 months ago
  - Last dilated eye exam 2 years ago
  - Little or no obvious NPDR on first glance [but featureless retina!!!]
  - High risk PDR and early DME

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**Other Diabetic Eye Changes**
- **Diabetic papillopathy**
- **Tilted disc**

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**Optic Nerve Disorders in Diabetes**
- **Diabetic papillopathy**
  - Juvenile-onset diabetics aged 10-30; but may be older with Type II
  - Ischemic papillopathy; usually bilateral
  - Appears like papilledema; macular edema may accompany
Optic Nerve Disorders in Diabetes

- Diabetic papillopathy
  - Vision loss is variable and may be transient
  - Recovery is usually spontaneous but may take 6-12 months with residual OA
  - Examples…

Diabetic Papillopathy

- Mild, diffuse OHN swelling 63 W/M 20/40
- Disc staining on FA, with patchy capillary dropout, & leakage around macula

Diabetic Papillopathy

- Moderate involvement w/ teleangiectasis
- 41 F 20/60
- Note: no leakage of teleangiectatic capillaries

Diabetic Papillopathy

- Severe disc swelling w/ hemorrhages and teleangiectasis
- 19 W/M 20/20

More case examples

NPDR (OU) w/ Stable PRP

- 54 B/M
- IDDM X 20 years; BS range 180-230
- BCVA: 20/40- / 20/50- (OU 20/40)
- Lens: 2+ - 3+ ns (OU)

- Fundus: (-) NV & CSME (unchanged for 41 mo; [04/16/98])
NPDR (OU) w/ Stable PRP

NPDR (OU) w/ Stable PRP

NPDR (OU) w/ Stable PRP X 2 yrs

NPDR (OU) w/ Stable PRP X 2 yrs.

NPDR (OU) w/ Stable PRP X 3 yrs

NPDR (OU) w/ Stable PRP

PLAN...

• Follow 4-6 months.
Case Examples in Diabetic Retinopathy

- NPDR W/ CSME

NPDR w/ CSME (OS)
- 62 B/M 10/16/01
- IDDM X 13 years, BS: 140 [range 130-289]
- HTN X 13 years
- BCVA 20/20 - / 20/400

F/U: moderate – severe NPDR (OS>OD; CSME OS; Old RD [OS]

NPDR (OD) 10/16/01
- CWS, IRMA, scattered H's & E's

NPDR (OD)
- CWS, IRMA, scattered H's & E's
- Collaterals on disc, macula elevated [CSME]

NPDR w/ CSME (OS)
- CWS, IRMA, scattered H's & E's, Collaterals on disc, macula elevated [CSME]

NPDR w/ CSME (OS)
NPDR w/ CSME (OS)

- 62 B/M
- A & P:
  - NPDR [OU]
  - CSME [OS]
  - Focal laser OS X 2 d

NPDR w/ CSME (OS) X 4mo.

Case examples in Diabetic Retinopathy

- PDR (S/P PRP; Mild NPDR)
**PDR**
- 44 B/F (first seen 9/25/00)
- IDDM X 11 years; BS: 160-190
- "Borderline" HT (HCTZ, Monopril)
- BCVA: 20/25 - / 20/20 -
- 1+ lens changes
- few H & E (OD,OS); CWS OS; gliosis [aka FPD]
- A & P: PDR, retinal consult

**Progression of NPDR X 19 mo.**

Baseline (4/07)

11/07 (X 7 mo; note CWS, more heme [inf. OS])
Progression of NPDR X 19 mo.

9/09 note increased exudates and disappearance of CWS (OS)

Progression of NPDR X 19 mo.

- No Neovascularization
- No CSME

NPDR over 9 months (34 BM)

Baseline: 03/09; 20/20 OD, OS throughout

X 3 mo

Note CWS X 2 (OD), 1 OS

X 6 mo from original exam

Note: CWS have disappeared (OD), intensified OS
Mild PDR (S/P PRP 03/01)
- 44 B/F 09/04/01
- BCVA: 20/25- / 20/20-
- Fundus
  - (OD): few H & E, IRMA, PRP 360; regressing NVD
  - (OS): few H, regressing NVE, vitreous traction 360 W/O TRD
- A & P: stabilizing PDR s/p PRP; NOT high risk PDR (OS); Follow & recheck 4 mo or prn

Mild NPDR (44 BF) X 1 yr.
Regressing FPD;
VA 20/30 OD, OS

Mild NPDR x 1 yr
VA 20/25+ (OD, OS)
S/P PRP

Case Examples in Diabetic Retinopathy -PDR
- 49 BF
- 15-year Hx. Diabetes, IDDM
- S/P PRP 1997 (?)
- LEE: X 2 years

X 9 mo from original exam
Note CWS, heme and retinal vasc dropout.
PDR - 49 BF
- BS 98 (last night)
- BCVA 20/30 (OD, OS)
- Mild – Mod NPDR OD>OS RTC 3-4 mo
- RTC 08/06/02...
- BCVA 20/25, 20/30 (OD, OS)

PDR (X 18 mo since initial visit)
VA 20/25, 20/30 (OD, OS); NVD
Follow 2 months

PDR (X 2 weeks) OD

PDR OS

PDR (X 2 mo)
- NVD progression
- Schedule another round of PRP

PDR (X 5 mo) S/P PRP
PDR (X 5 mo) S/P PRP
NVD resolved / resolving

Fibrous proliferation at the disc (FPD – OD, OS)

PDR X 2 more mo.) S/P PRP
FPD w/ HRC (elevation) – Needs another round of PRP

Note disc collaterals and peripheral traction

Traction retinal detachment (9/09)
Looks ‘schisis-like’

Same patient (OS)
Previous patient’s sister 9/06

Significant fibrous proliferation and exudate.

OS with PRP, fibrous proliferation 9/06

1/07 (X 4 mo.)

Note traction

12/07 (X 13 mo. from baseline)

Note improved exudative pattern and stable macular appearance

12/07 (X 13 mo. from baseline)

Note traction/proliferation and PRP.
Note change in exudative pattern.

Patient finally convinced at this visit to visit retina specialist.

Note proximity of exudative pattern temporal to macula.
Patient scheduled for anti-VEGF injection and encouraged to keep appointment

Case Example

37 BM  
30-yr Hx IDDM  
S/P PRP  
BCVA = 20/15

OS
37 BM (OS)  
BSCVA 20/15
How would you manage this patient?

Avastin (intravitreal for PDR)
62.5 ug - 1.25 mg

Regression of INV and NVD
1 week

Regression of NVD
1 week
A. & D R/F
B. & E midphase
C. & F. late phase
Baseline & 1 week S/P

Regression of NVD
@ 3 weeks
A. & D R/F
B. & E midphase
C. & F. late phase
Baseline & 3 week S/P

Regression of INV and NVD @ 6 weeks
Horizontal and vertical representative sections
Avastin (intravitreal for PDR)

Before injection

After injection of the fellow eye

Regression of NVD in fellow (untreated) eye X 1 wk


49 BF IDDM X 25+ years

- 1/12/07
- BS runs in “the 300s”
- VA 20/20 - OD
- Scattered H&E
- No NVD, NVE
- RTX X 1 Mo, Re✓ for CSME

49 BF IDDM X 25+ years

- VA 20/20 OS
- NOTE: tortuous retinal vasculature, more H & E, some IRMA; moderate NPDR
- RTC X 1 Mo, Re✓ for CSME

49 BF IDDM X 25+ years X 6 Mo.

- Returns in 7 Mo.
- VA 20/20
- Scattered H&E
- Mild NPDR; more H & E
- RTC X 3 Mo, Re✓ for CSME

49 BF IDDM X 25+ years X 6 Mo.

- Returns in 7 Mo.
8/9/07
- VA 20/20
- Scattered H&E
- Moderate NPDR; tortuous vasculature
- RTC X 3 Mo, Re✓ for CSME
49 BF IDDM X 25+ years X 12 mo.
- Returns in 6 1/2 Mo.
- VA 20/20
- Scattered H&E
- Mild NPDR; more H & E
- RTC X 3 Mo. Re for CSME

49 BF IDDM X 25+ years X 12 Mo.
- Returns in 7 Mo. 1/24/08
- VA 20/20
- Scattered H&E
- Moderate NPDR; tortuous vasculature
- RTC X 3 Mo. Re for CSME

49 BF IDDM X 25+ years X 26 mo.
- Returns in 13 1/2Mo.
- VA 20/20
- Scattered H&E
- Mild NPDR; more H & E
- CSME !

49 BF IDDM X 25+ years X 26 Mo.
- Returns in 13 1/2 Mo. 3/10/09
- VA 20/20
- Scattered H&E
- Mod to Severe NPDR; IRMA, VB
- CSME (worse OS); proliferative changes, too

51 BF 3/11/09
- OCT Shows distinct CSME confirming clinical assessment
- Plan:
  - Focal laser OS
  - PRP OS
  - Avastin OS
- Then same X 1 week OD
OCT Shows distinct CSME confirming clinical assessment

Plan:
- Focal laser OS
- PRP OS
- Avastin OS
Then same X 1 week OD

81 BM 8/7/07
- Long standing HX Diab – Old DME
- VA LPO
- Plan: follow X 3 mo

81 BM 1/12 07
- Long standing HX Diab and POAG
- TX: (Lumigan qhs) + Alphagan tid (OD); end stage glaucoma
- LPO
81 BM 1/12 07
- Long standing HX Diab - CSME

81 BM 8/7/07
- OS
- VA 20/40
- Plan: follow X 3 mo.

81 BM 12/16/08
- OS
- VA 20/40, (-)CSME
- Plan: follow X 3 mo

81 BM - OCT 12/16/2008
- POAG (Lumigan qhs) + Alphagan tid (OD); end stage glaucoma
- IOP 21, 14
- NOTE (OS)
  - Thin to absent GCC
  - Significant macular thickening
  - Intact PRE

Plan: follow

Guideline for Initial / Follow-up Eye Examination

<table>
<thead>
<tr>
<th>TIME OF ONSET OF DIABETES</th>
<th>RECOMMENDED TIME OF FIRST EXAMINATION</th>
<th>MINIMAL INTERVAL BETWEEN ROUTINE FOLLOW-UP VISITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>At less than 30 years of age</td>
<td>5 Years after onset or at puberty</td>
<td>12 Months</td>
</tr>
<tr>
<td>At 30 years of age or older</td>
<td>At time of diagnosis</td>
<td>12 Months</td>
</tr>
<tr>
<td>Before pregnancy</td>
<td>Just before or soon after conception</td>
<td>At least every 3 months</td>
</tr>
</tbody>
</table>