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15 years

Advancing Your Career in Diabetes Education

Microvascular Complications of Diabetes – Prevention and Treatment of Eye, Kidney and Nerve Disease

www.DiabetesEd.net
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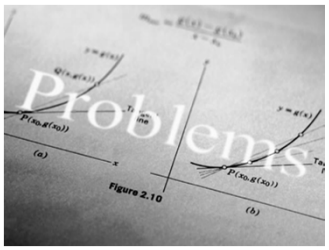
President, Diabetes Education Services

Diabetes – Microvascular Complications

- Microvascular Complications
  - Diabetic eye disease, nephropathy, neuropathy, foot complications and dental problems



Diabetes –Microvascular Complications and Goals of Care

Objectives:

- Identify 3 microvascular complications
- Describe modifiable and non-modifiable risk factors for diabetes complications
- List screening guidelines

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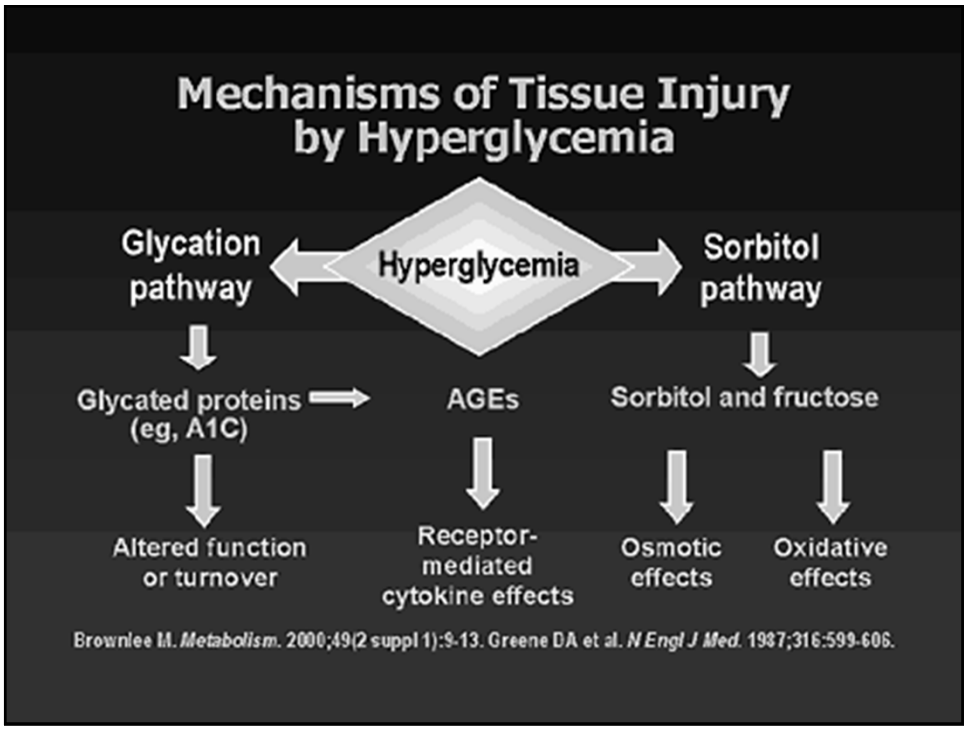
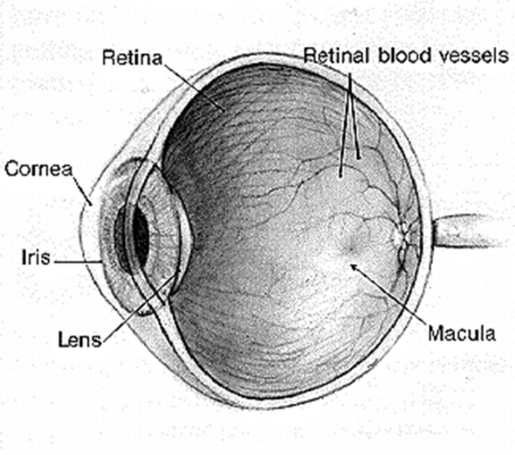


Quick Question 1

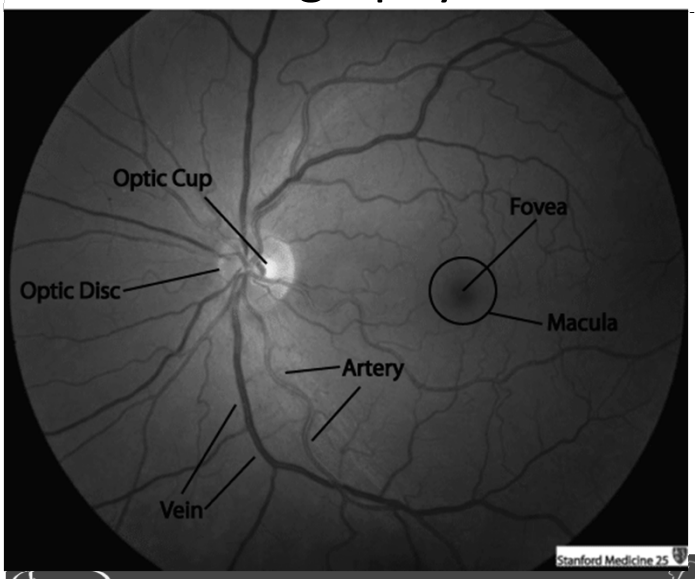
- Which of the following are modifiable risk factors for microvascular disease?
  - A. Blood pressure, glucose levels, smoking
  - B. Age, type A personality, blood pressure
  - C. Ethnicity, blood pressure, diet
  - D. Blood glucose, genetics, activity level

Eye Disease and Education

- Diabetes Retinopathy
- Other Diabetes Eye Complications
- Prevention and Treatment
- Promoting Self-Care



Fundus Geography



The retina is the only portion of the central nervous system visible from the exterior. Likewise the fundus is the only location where vasculature can be visualized.

Fundoscopy

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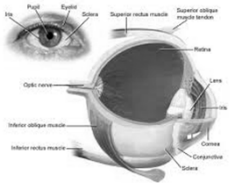
Eye Disease Overview

- Leading cause of adult blindness
  - Retinopathy and Diabetic Macular Edema
- DM = 25x's risk of ocular complications
  - Including cataracts
- 20% of type 2 have retinopathy at diagnosis
- Only 60% of pt's receive appropriate treatment



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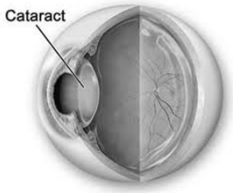
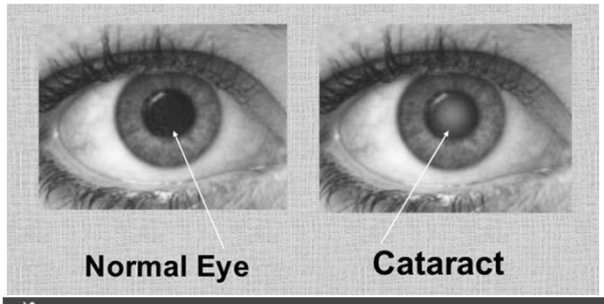
Retinopathy Risk Factors

- Duration of diabetes, age at diagnosis, race other genetic factors
- Glycemic control, hypertension, smoking, hyperlipidemia, proteinuria and renal disease

Cataracts

- Cataracts – elevated glucose levels glycosylate lens, decreasing permeability
  - Treatment = surgery





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Macular Edema

- Macular edema
  - Risk 10-15% for pt's with dm 15yrs +
  - macula responsible for central vision
  - retinal thickening w/in 3mm from the macula
  - can impair central vision – causing blurring to blindness
  - Tx: focal laser treatment or
  - Lucentis, Avastin or Eylea, injected into eye

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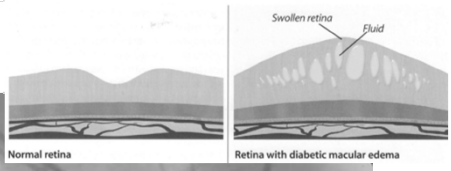
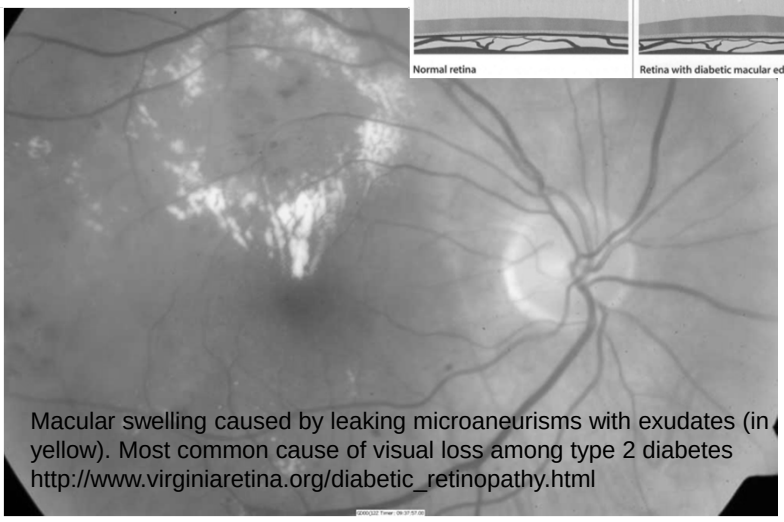
Macular Edema





Macular swelling caused by leaking microaneurisms with exudates (in yellow). Most common cause of visual loss among type 2 diabetes
http://www.virginiaretina.org/diabetic_retinopathy.html

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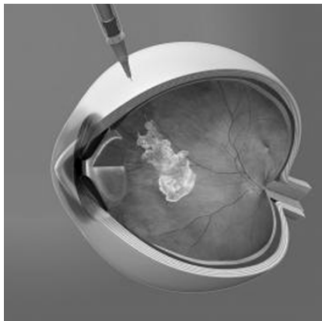
New Approved Treatment for Macular Edema

- Anti-vascular endothelial growth factor (VEGF) therapy is indicated for diabetic macular edema
- Trials using Ranibizumab (Lucentis) Avastin or Eylea demonstrated improved vision with treatment
- Once a month injection



Quick question 2

- Which of the following describes proliferative retinopathy?
  - A. Cotton wool spot and hemorrhages
  - B. Increased lens opacity
  - C. Stiffening of the lens
  - D. New blood vessel growth

What is Retinopathy?

- Retina – layer of nerve tissue in back of eye responsible for processing images and light
- Damage to the microvascular layer that nourishes the retina
- Leads to leakage of blood components through vessel walls and creation of unstable blood vessels secondary to hypoxia
- Disturbance in nerve layer = visual symptoms

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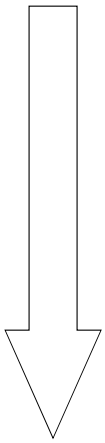
Natural History of Diabetic Retinopathy



- Mild nonproliferative diabetic retinopathy (NPDR)
  - Microaneurysms only
  - Reexamined annually
- Moderate NPDR
  - Microaneurysms plus other abnormalities
  - Reexamined w/in 6-12 months

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Severe non-proliferative retinopathy

- Any of the following:
  - 20+ intraretinal hemorrhages in each 4 quadrants
  - Venous beading in 2 or > quadrants
  - Prominent intraretinal microvascular abnormalities in 1 or more quadrant
  - No signs of proliferative disease
- Reexamination several times a year

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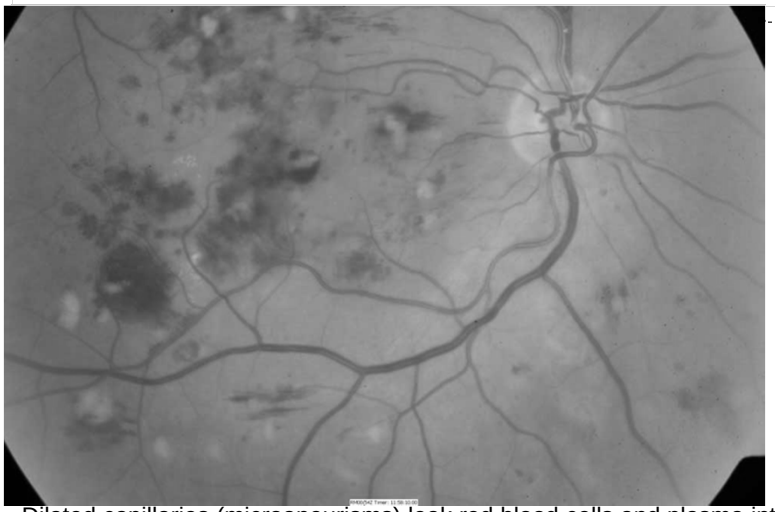
Non Proliferative



Dilated capillaries (microaneurisms) leak red blood cells and plasma into retina. Results in retinal hemorrhages, edema and deposits (exudates).

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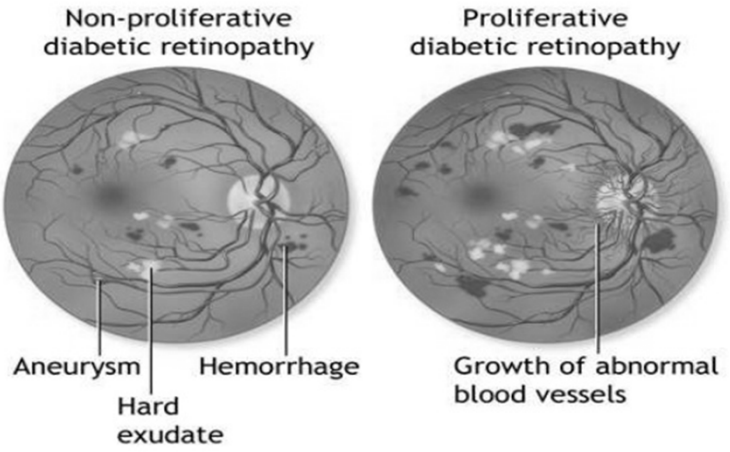
Non - Proliferative to Proliferative Diabetic Retinopathy



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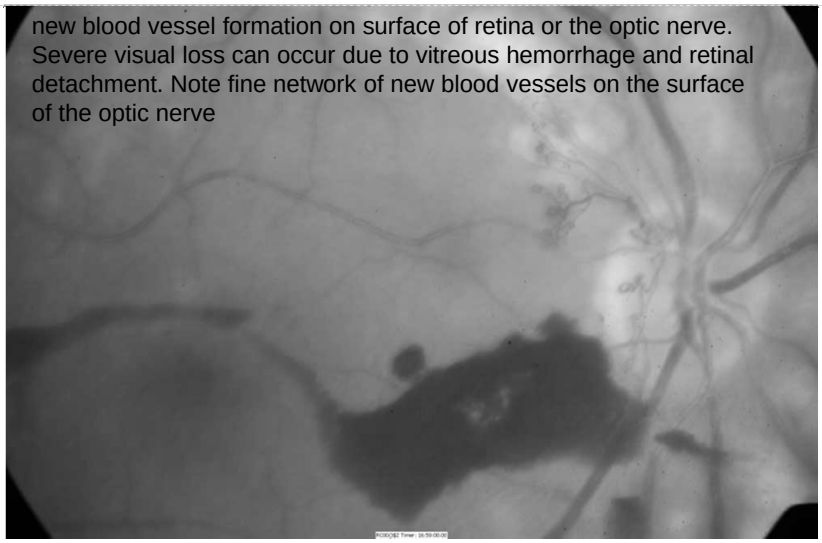
Proliferative retinopathy



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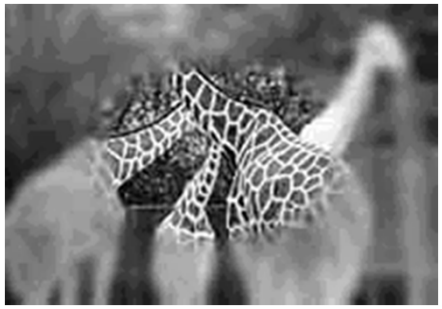
PDR Signs

Blurred central or side vision (left, blurred side vision) or a blind spot in central vision (right) may indicate diabetic retinopathy



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Retinopathy Changes How We See

View of boys by person with normal vision

View of boys by person with diabetic retinopathy.

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Proliferative Diabetic Retinopathy (PDR)

- Clinical Findings
  - Ischemia induced neovascularization
    - at the optic disk (NVD)
    - elsewhere in the retina (NVE)
  - Vitreous hemorrhage
  - Retinal traction, tears, and detachment
  - Diabetes Macular Edema must also be evaluated

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PDR Management

- Management/Treatment
  - 2-4 month follow-up
  - Color fundus photography
  - Panretinal photocoagulation (3-4 month follow-up)
  - Vitrectomy if bleeding into vitreous
  - If macular edema present: fluorescein angiography and injected meds

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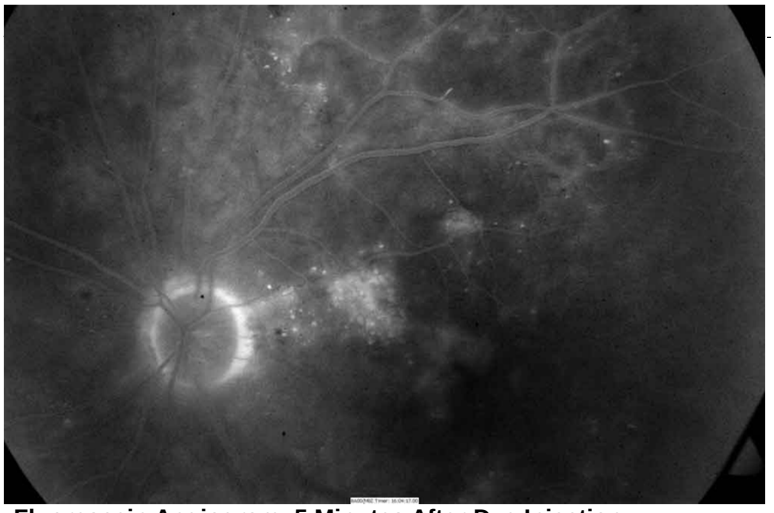
Fluorescein Angiogram



Fluorescein Angiogram, 5 Minutes After Dye Injection.
Fuzzy white areas represent dye leaking into retina from microaneurisms.
This illustrates the mechanism which causes macular edema.

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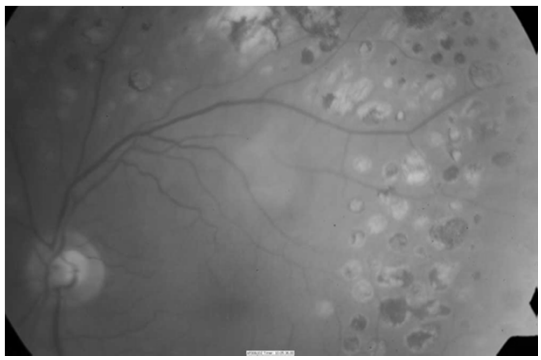
Pan Retinal Photocoagulation



Decreases risk of severe vision loss by 50% or more
Destroys 12% of retina and loss of visual field.
Once stabilized, can achieve excellent control of PDR
if B/P and BG well controlled.

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Retinopathy Prevention

- To reduce the risk or slow the progression of retinopathy
  - Optimize glycemic control
  - Optimize blood pressure control

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Quick Question 3

- Which of the following is correct regarding eye screening for people with diabetes?

A. All people with diabetes must get a complete eye exam every year

B. All people diagnosed with type 1 should receive an immediate eye exam.

C. All people diagnosed with type 2 should receive an immediate eye exam.

D. People with diabetes over age of 60 should receive an eye exam every 6 months.

qu?z

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Retinopathy Screening

- Screen with initial dilated and comprehensive eye exam by ophthalmologist or optometrist
  - Type 2 at diagnosis, then every 1 to 2 years
  - Type 1 within 5 yrs of dx, then every 1-2 years
- Can use high quality fundus photography as screening tool- Initial exam should be done in person
- Promptly refer pts with macular edema, and severe non-proliferative disease to trained specialist

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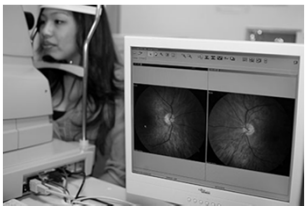
High Quality Fundus Photography to Screen for Retinopathy



Can detect most clinically significant diabetic retinopathy

- Interpretation of the images
  - Performed by a trained eye care provider
- May serve as a screening tool for retinopathy, it is not a substitute for a comprehensive eye exam
- Perform comprehensive eye exam at least initially and at intervals thereafter

Retinopathy Screening

- Women with preexisting diabetes who are planning pregnancy or are pregnant
  - Comprehensive eye examination in the first trimester
  - Close follow-up throughout pregnancy and for 1 year postpartum

Ongoing Retinopathy Screening

After initial exam, then…

- Annual exam
- Less frequent (every 2-3) yrs can be considered if 1 or more normal eye exam
- More frequent exams if retinopathy progressing

Assess adaptation to low vision

- necessary vision to perform self-care skills?
  - insulin
  - BGM
  - read instructions
  - shopping/home safety/transportation
- refer to rehab education (800-AFBLIND)
- psychosocial issues

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Prodigy Voice Meter – A+ Access Award Am Fed Blind

Prodigy Meter only completely accessible meter for sale in U.S. - independent access for visually impaired -

- www.prodigymeter.com
- 800-243-2636
- Independent set up
- Self coding
- Audible Memory
- Audible warning/error
- Cost: $84.95
- 50 Strips $34.95

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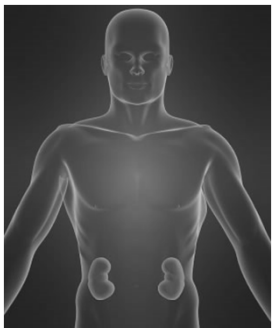
Nephropathy Objectives

- Epidemiology of diabetes nephropathy / Kidney Disease
- Basic functions of the kidney
- Major stages in progression of nephropathy
- Diagnostic tests to assess and monitor renal function
- Treatment and prevention



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Quick Question 4

- John's dad had diabetes and kidney failure. He wants to learn the risk factors for kidney disease. Which of the following describe those at increased risk for kidney disease?
  - A. Excessive alcohol intake and daily Tylenol
  - B. Family history of kidney disease, smoking
  - C. High protein diet and excessive trans-fat intake
  - D. Diet high in processed foods and sodium

qu?z

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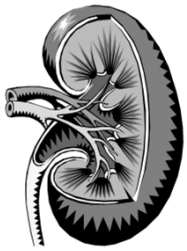
Kidney Physiology

- Size and shape of Idaho potato - retroperitoneal
- Filter entire blood volume every 30 minutes
- excretory organ:
  - removes water, urea, waste
  - maintains blood volume
  - acid base balance and lytes
  - regulates B/P
  - synthesizes erythropoietin – RBC
  - Maintains calcium /phosphorus levels, activates vitamin D – helps absorb calcium



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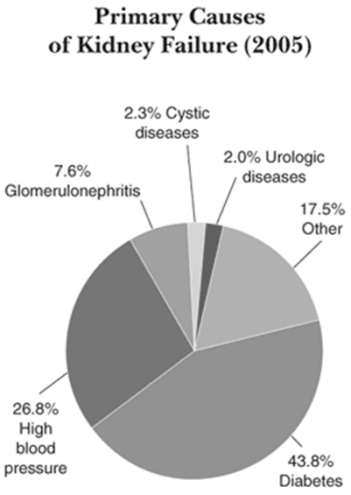
Risk Factors of Kidney Disease

- 2 leading risk factors: Hypertension and hyperglycemia
- Other risk factors:
  - Kidney stones, obesity, smoking and CV disease
  - Family history of kidney disease and age 60 or older
- Kidney disease often has no symptoms, can undetected until very late

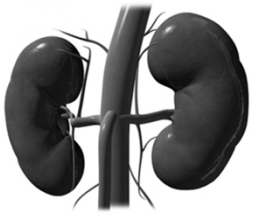
Diabetic Nephropathy

- Most new cases of Chronic Kidney Disease **(CKD)** are attributed to diabetes.
- 220,000 people in US have kidney failure due to diabetes (2013)
- Minorities experience higher than average rates of nephropathy and kidney disease



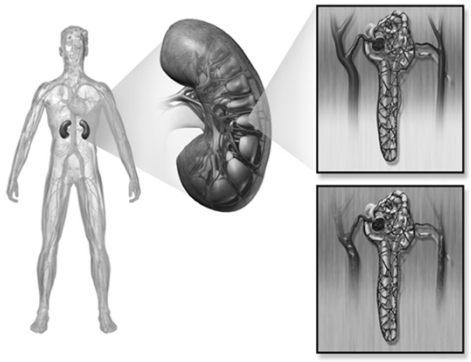
Diabetes and Chronic Kidney Disease (CKD) Considerations

- CVD leading cause of death in CKD
  - microalbuminuria = increased risk of CVD
- 1/4 to 1/3 of insulin cleared by kidney
- renal retinal syndrome
- 70 - 80% of people with diabetse DON'T get kidney disease
- Early and aggressive intervention crucial



What is Nephropathy?

- Hyperglycemia causes renal hyperfiltration and glomerular capillary hyperperfusion.
- Causes functional and structural damage to glomeruli, increasing permeability, proteinuria, mesangial expansion and sclerosis… destroys nephrons
- Due to insufficient insulin, glycosylation, increased growth hormone, glucagon, and vasoactive hormones.



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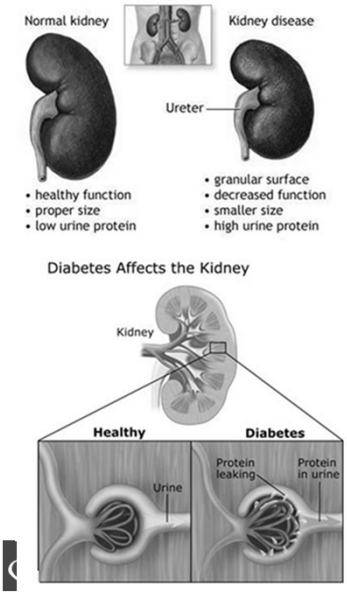
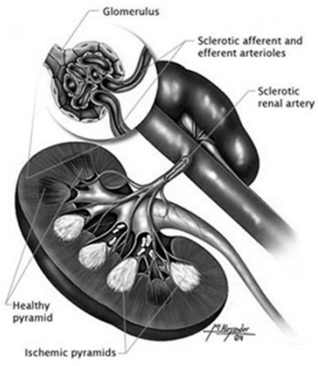
Nephropathy





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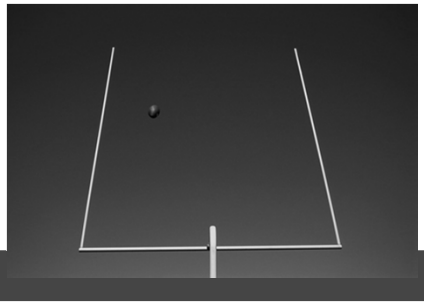
Keep Kidneys Healthy

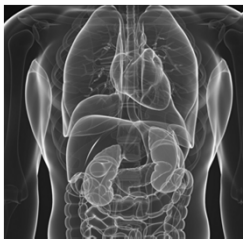
To reduce the risk or slow the progression of nephropathy

- Optimize glucose control (A)
- Optimize blood pressure control (A)



Screening for Kidney Disease

- Screen for:
  - Urine Albumin-Creatinine Ratio (UACR) and
  - Glomerular Filtration Rate (GFR):
- Type 2 at dx then yearly
- Type 1 with diabetes for 5 years, then yearly
- Measure serum creatinine and GFR yearly
- Treat hypertension and intensify as needed



Definitions of Abnormalities in Albumin Excretion

- Urine albumin – creatinine ratio (spot collection)

Category	mg/g creatinine
normal	<30
Increased urinary albumin excretion	30-299

- 2 of 3 tests w/in 3-6 mo abnormal to confirm
- Exercise within 24 h, infection, fever, CHF, marked hyperglycemia, and marked hypertension may elevate urinary excretion over baseline values. ***ADA***

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Stages of Chronic Kidney Disease

Table 9.2—Stages of CKD

Stage	Description	GFR (mL/min/1.73 m^2)
1	Kidney damage* with normal or increased GFR	≥90
2	Kidney damage* with mildly decreased GFR	60–89
3	Moderately decreased GFR	30–59
4	Severely decreased GFR	15–29
5	Kidney failure	<15 or dialysis

*Kidney damage is defined as abnormalities on pathological, urine, blood, or imaging tests.
Adapted from Levey et al. (37).

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ADA Management of CKD

Table 9.3—Management of CKD in diabetes (7)

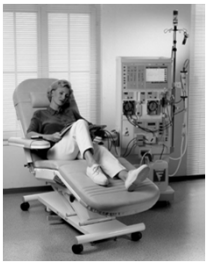
GFR (mL/min/1.73 m^2)	Recommended management
All patients	Yearly measurement of creatinine, urinary albumin excretion, potassium
45–60	Referral to a nephrologist if possibility for nondiabetic kidney disease exists (duration of type 1 diabetes <10 years, persistent albuminuria, abnormal findings on renal ultrasound, resistant hypertension, rapid fall in GFR, or active urinary sediment on ultrasound) Consider the need for dose adjustment of medications Monitor eGFR every 6 months Monitor electrolytes, bicarbonate, hemoglobin, calcium, phosphorus, parathyroid hormone at least yearly Assure vitamin D sufficiency Consider bone density testing Referral for dietary counseling
30–44	Monitor eGFR every 3 months Monitor electrolytes, bicarbonate, calcium, phosphorus, parathyroid hormone, hemoglobin, albumin, weight every 3–6 months Consider the need for dose adjustment of medications
<30	Referral to a nephrologist

Kidney disease treatment - ADA

- ACE or ARB NOT recommended for prevention of kidney disease if BP normal and urinary albumin excretion (UAE) < 30 mg/g
- ACE or ARB if UAE of >30 mg/g
- Monitor creat and K+ when on ACE or ARB
- When GFR < 60, evaluate/manage potential complications of CKD
- Consider referral to specialist when management is difficult and kidney disease is advanced
- Protein restriction not recommended

Treatment of Chronic Kidney Disease (CKD)

There are four primary treatment options for individuals who experience ESRD:



1. Hemodialysis
2. Peritoneal Dialysis
3. Kidney Transplantation
   - 120, 000 Americans waiting for kidney
   - Only 17,000 receive one each year
   - Every day, 12 people die waiting for a kidney
4. No treatment

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Psychosocial Issues associated with Chronic Kidney Failure

- depression
- stress
- anxiety
- support groups, counseling and coping skills

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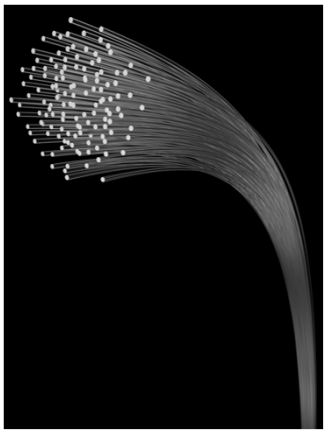
Diabetes Nerve Disease Objectives

- Causes of neuropathy
- Different types of neuropathy
- Detection, prevention and treatment
- Key info to teach about neuropathy



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Microvascular Disease and Polyol Theory

- hyperglycemia ↑ glucose level in cells
- sorbitol pathway - glucose reduced to sorbitol by aldose reductase
- polylol pathway - sorbitol oxidized to fructose by sorbitol dehydrogenase
- glucose, sorbitol, fructose toxic to cells
- ⇩nerve velocity, oxygenation, increases oxidative stress

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Quick question 5

- Mary has had diabetes for 10 years and wants to reduce her risk of neuropathy. What are most important steps she can take to limit risk?
  - A. Lose weight and decrease coffee intake
  - B. Control blood glucose
  - C. Take vitamin B12 daily
  - D. Apply capsaicin cream to extremities twice daily.

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What is Neuropathy?

- Diabetic Neuropathy (DN) = demonstrable nerve disorder and destruction, either clinical or subclinical- that occurs w/ diabetes, w/out other causes (10% of neuropathy due to other causes)
- 2 abnormalities present (symptoms, signs, abnormal quantitative test results)

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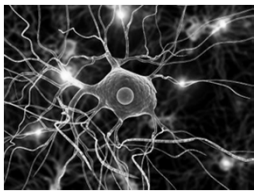
Neuropathy Risk Factors

- Age
- Hypertension
- Hyperglycemia
- Elevated LDL
- Smoking
- Overweight
- Excess alcohol
- Nutrition (eat lots of omega-3 fatty acids)
- Lack of exercise

Quick Question 6

- What 2 office tests can be used to detect diabetes neuropathy?
  - A. Pin prick and electrophysiology testing
  - B. Monofilament and tuning fork
  - C. Hot/Cold discrimination testing
  - D. Babinski reflex assessment

Nerve disease Screening



- Screen all patients for nerve disease using simple tests, such as a monofilament
  - Type 2 at diagnosis, then annually
  - Type 1 diabetes at 5 years, then annually
- **Tight glycemic control is the only strategy shown to prevent or delay the development and progression of neuropathy.**
- Assess and treat patients to reduce pain and symptoms to improve quality of life.

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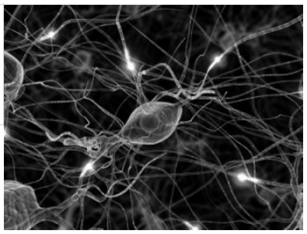
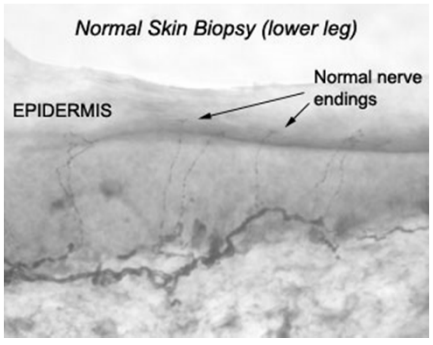
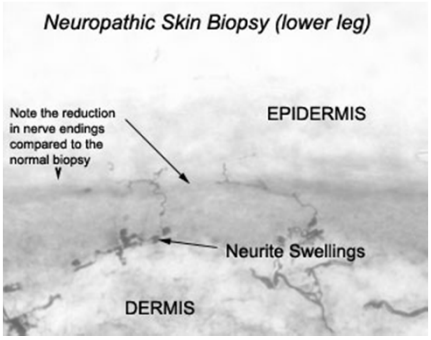
Skin Biopsy to Assess Neuropathy

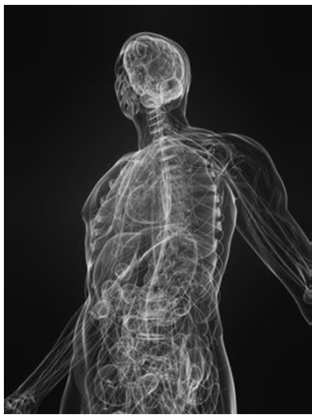






3 Types of Neuropathy

- Generalized Symmetrical Polyneuropathy
  - Acute sensory
  - Chronic sensory (distal)
    - Small fiber
    - Large fiber
- Autonomic Neuropathy
- Focal and Multifocal Neuropathy



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Generalized Symmetrical Polyneuropathy - Acute Sensory Neuropathy

- Severe pain, wasting, weight loss, depression and erectile dysfunction
- Foot pain- burning, unremitting, deep, sharp, stabbing, “shock like”..worse at night, hypersensitive to light touch
- Associated w/ hyperglycemia or w/ rapid improvement of glucose
- Goal – improve BG – resolve in year

Generalized Symmetrical Polyneuropathy
Chronic Sensorimotor Neuropathy
Small Nerve Fiber

- Sensory deficits in distal portions, spreading medially “stocking-glove”
- Small Nerve Fiber Neuropathy
  - C-fiber pain = burning and superficial
  - Allodynia (all stimuli interpreted as painful)
  - Later, loss of pressure and temp sensation
  - Decrease blood flow, sweating
  - Detect w/ Monofilament
  - High risk for ulceration, Charcot, gangrene

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Generalized Symmetrical Polyneuropathy
Chronic Sensorimotor Neuropathy – *Large Nerve Fiber*

- Involve sensory and/or motor nerves
- Fibers are myelinated, rapid conductors
- Can detect destruction w/ nerve testing
- Symptoms may be minimal:
  - Impaired vibration perception/position sense
  - Ataxia “moon-walking”, in-coordination
  - Pain described as deep-seated gnawing
  - Shortening of Achilles tendon and claw foot
  - Increased blood flow “hot foot”

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Treating Neuropathy

- Improve glycemic control
- Control pain
- Relief from depression from chronic pain
  - Massage, stretching, pain control clinic, TENS, avoiding alcohol, relaxation exercises....

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Pharmacologic Therapy for Neuropathy

Try Alpha lipoic acid: 600 – 1,800mg /day

Prescription Therapy

1st line

- Tricyclic antidepressants (ie amitriptyline, nortriptyline
- Calcium channel modulators (ie gababentin, pregabalin)
- Serotonin Norepinephrine Reuptake Inhibitors (SNRI)

2nd line

- Topical Capsaicin Cream
- Opioids (tramadol, oxycodone)

Reasons for treatment failure:

- Dose too low, inadequate trial, pt expecting elimination of symptoms, not changing class when no response

Ziegler, D Painful diabetic neuropathy. Diabetes Care, 2009

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Quick Question 7

- Which of the following patients are at most risk for developing diabetes autonomic neuropathy?

A. Diabetes for 1 year with A1c of 7.6%
B. Person with diabetes for 16 years with A1c never above 6.9%
C. Person with type 1 diabetes for 8 years with retinopathy
D. Person with type 2 for 19 years with A1c less than 7.5%

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"DAN" Diabetic Autonomic Neuropathy

- 50% of pt's with peripheral neuropathy also have DAN
- DAN increases M & M rates
  - neurogenic bladder, sexual dysfunction
  - GI related disorders / gastroparesis
  - orthostatic hypotension
  - fixed heart rate, silent MI, sudden death
  - hypoglycemia unawareness
  - sudomotor, pupillary

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Sexual Functions as We Age

- 20-30 years — trice daily
- 30-40 years — tri weekly
- 40-50 years — try weekly
- 50-60 years — try weakly
- 60-70 years — try oysters
- 70-80 years — try anything
- 80-90 years — try to remember

A touch of humor from AADE-New Perspectives on Erectile Dysfunction, 1999

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Erectile Dysfunction

- Affects about 50% of men with diabetes
- Loss of erections sufficient for intercourse
- Due to combo of vascular and nerve damage
- Tests: penile tumescence to eval if organic or psychogenic
- Treatment:
  - Sildenafil (Viagra), Vardenafil (Levitra), Tadalfil (Cialis)
    - Use caution if taking nitrate drugs. Check w/ MD first
  - Other meds, vacuum devices, prosthetics
  - HRT- testosterone gel, patches, injections, pills

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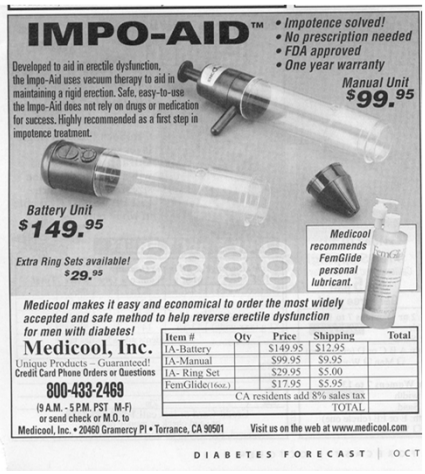
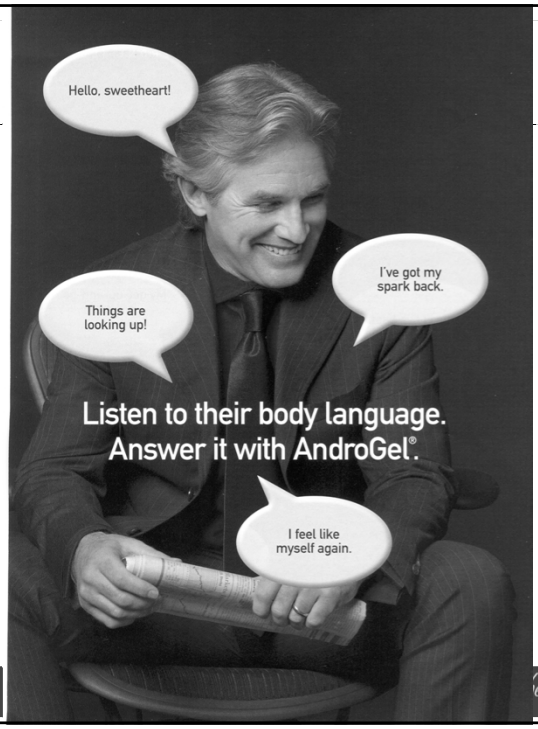
Assistive Devices



Take Charge. Talk T.

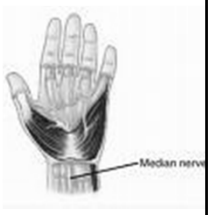
www.diabeteseducator.org

- Men w/ DM, 2x risk of low testosterone levels
  - Symptoms include low sex drive, ED, depression, lack of energy and vitality
  - Low T easily diagnosed and managed, only 10% of men currently treated
  - Initial Screening:
    - Total testosterone: if < 300 ng/dl = hypogonadal
    - am testing preferred, repeat to confirm
  - Treatment: determine cause, testosterone replacement therapy



Focal Neuropathies

- Often occurs in middle aged pt's or those w/ polyneuropathy
- 4 major focal neuro
  - mono - compression or entrapment
    - carpal tunnel most common
  - plexopathy- femoral neuropathy
    - pain from hip to ant and lat aspects of thigh
  - radioculopathy - intercostal neuropathy
  - cranial - abrupt onset, HA, eye pain



Neuropathy Key Considerations

- Very common long-term complication often not recognized and treated
- Management / treatment complex
- Thorough history /assessment critical
- Treatment based on underlying process, presentation, and cost effectiveness
- Treatable condition with new therapies on horizon.

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The ABC's of Diabetes Control

A - A1c less than 7%

B - Blood pressure less than 140/90

C - Cholesterol HDL > 40, Triglycerides < 150

D - Drugs- Keep list for emergencies/ MD

E - Exercise and Eyes

F - Food and Feet

G – Glucose checks and goals

H- Healthy Coping - Hoorah for your hard work!

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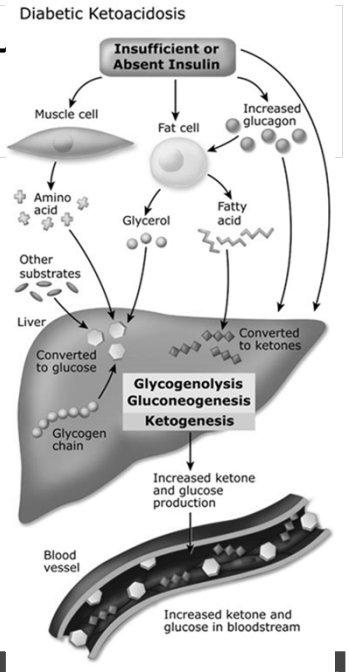
Hyperglycemic Crisis – See Online Courses



Thank You

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- Web
  www.diabetesed.net