Laboratory Testing: The Basics

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Case
- 48 yr old white female presents with acute loss of vision in her right eye and decreased vision in her left
  - She was scheduled 2 weeks previously for an eye exam on a referral from her PCP but had fallen and was unable to make that appointment
  - She reports that her vision in her right eye seems to be getting worse over the past several weeks.
  - Was diagnosed with diabetes 1.5 years ago
    - BS control has been erratic with range between between 6.7-13.3 (120-240)
    - Last A1C: 9.1

Blood Sugar
- HbA1c:
  - higher the glucose concentration in blood, the higher the HbA1c.
  - HbA1c are not influenced by daily fluctuations in the blood glucose concentration but reflect the average glucose levels over the prior six to eight weeks
    - useful indicator of how well the blood glucose level has been controlled in the recent past and may be used to monitor the effects of diet, exercise, and drug therapy on blood glucose in diabetic patients.

Type 1 Diabetes Treatment
- The new HbA1c target of less than 7.5% across all pediatric age groups
- The adult HbA1c target of less than 7%
  - Less stringent A1C goals (such as <8%)
    - history of severe hypoglycemia,
    - limited life expectancy,
    - advanced microvascular or macrovascular complications,
    - and extensive comorbid conditions and in those with longstanding diabetes in whom the general goal is difficult to attain

Blood Sugar
- Hypoglycemia is typically defined as plasma glucose 70 mg/dl (3.9 mmol/L) or less
  - patients typically become symptomatic of hypoglycemia at 50 mg/dl (2.8 mmol/L) or less

Action Item
- Optometrists should have a rapid-acting carbohydrate (glucose gel or tablets, sugar–sweetened beverage or fruit juice) in their offices for use with diabetic patients who experience acute hypoglycemia during an eye examination
Hypoglycemia
Always have a rapid-acting carbohydrate in the office (juice, sugared soda, glucose gel) for pts on meds that can cause low blood glucose....

15gm CHO will ↑BG ~ 30-40 mg/dl (1.7-2.2 mmol/L)

Entrance Skills/Health Assessment
VA: OD: finger count
OS: 20/40 (6/12)
CVF: OD: unable to assess
OS: temporal hemianopsia
Pupils: sluggish reactivity with a 2+ RAPD OD
SLE: corneal arcus noted, no other significant findings
IOP: 16, 16 mmHG OD, OS
DFE: see photos

Physical Presentation
• Upon entering the room I noted that her right hand was twitching
  – I asked her how long that had been going on and she said about 2-3 weeks
  – I asked her if she experienced headaches, to which she said she had bad headaches that even woke her up at night

Referral
• Contacted her PCP who reported that she had examined the patient 3 weeks prior and had not noted any of these findings
• Referred the patient for an immediate MRI – wasn’t able to be scheduled until the next day

Imaging/Surgery Referral
• MRI revealed large mass in her brain
  – Patient was diagnosed with a Craniopharyngioma
  – She was referred for immediate surgery
  – Neurosurgeon reported that she removed a tangerine sized Craniopharyngioma
  – was the largest tumor she has ever removed

Craniopharyngioma
• Presenting signs and symptoms of increased intracranial pressure (80%)
  – Headache
  – Vomiting
  – Papilledema
  – Loss of vision and visual field (60%)
  – Diabetes (15%)
  – Mental deterioration or personality change (26%)
### Craniopharyngioma

- **Treatment:**
  - Therapy is often unsatisfactory
  - Total resection often results in major functional deficits
  - Partial resection followed by conventional radiation therapy as a more conservative approach has been recommended

### Pituitary Adenomas

- **The most common symptoms include:**
  - Headaches
  - Vision problems that cannot be easily explained
  - Menstrual cycle changes in women
  - Mood swings or behavior changes
  - Erectile dysfunction
  - Weight change

### Diabetes Lab Testing

- **Comprehensive medical panel will include:**
  - Serum glucose
  - Electrolytes
  - Liver enzymes
  - Kidney function:
    - BUN and creatinine
      - Elevated in renal failure
    - Glomerular filtration rate
      - Reduced in chronic kidney disease/renal failure

### Kidney Function

- **Urinalysis can be used in conjunction with blood testing to help confirm systemic etiology of conditions**
  - **Urine Glucose**
    - Any glucose in the urine is abnormal
  - **Urine Protein**
    - Proteinuria is an important indicator of renal disease
  - **Urine Ketones**
    - Ketones are byproducts of body fat metabolism formed in the liver
    - Ketonuria occurs in patients with diabetes

### Kidney Function Tests:

**Serum Creatinine:**
- waste product that comes from the normal wear and tear on muscles of the body.
- Kidney impairment results in rise of creatinine level in the blood

**BUN (blood urea nitrogen):**
- If kidneys cannot filter wastes out of the blood due to disease or damage, then the level of urea in the blood will rise

### Liver Tests

- **Liver tests (LTs) are blood tests used to reflect the presence of damage or inflammation.**
- **alanine aminotransferase (ALT)** and aspartate aminotransferase (AST) are the most commonly used tests
- These enzymes normally found in the blood when liver cells are injured.
Liver Tests

- The ALT is felt to be a more specific indicator of liver inflammation as AST is also found in other organs such as the heart and skeletal muscle.
- In acute injury to the liver, as in viral hepatitis, the level of the ALT and AST may be used as a general measure of the degree of liver inflammation or damage.

Liver Tests

- Bilirubin is the main bile pigment in humans which, when elevated causes the yellow discoloration of the skin called jaundice.
  - the bilirubin may be elevated in many forms of liver or biliary disease, it is relatively non-specific
- Albumin is a major protein which is formed by the liver.
  - chronic liver disease causes a decrease in the amount of albumin produced

Blood Chemistry: Lipid Profiles

Consists of:
- Serum lipids,
- Cholesterol,
  - High density lipoproteins (HDL) – “good” cholesterol
  - Low density lipoproteins (LDL) – “bad” cholesterol
  - Very-low density lipoproteins (VLDL) – dangerous cholesterol
- triglycerides

Current Recommended Lipid Levels

<table>
<thead>
<tr>
<th>Cholesterol Levels</th>
<th>&lt;50 mg/dL</th>
<th>&lt;100 mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>LDL Cholesterol</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>Ideal</td>
<td>Borderline high</td>
</tr>
<tr>
<td></td>
<td>Low density lipoproteins (LDL) – “bad” cholesterol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low density lipoproteins (VLDL) – dangerous cholesterol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;100 mg/dL</td>
<td>100-199 mg/dL</td>
</tr>
<tr>
<td></td>
<td>&gt;190 mg/dL</td>
<td>&gt;200 mg/dL</td>
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</tbody>
</table>

Case: Gonzalez

- 33 HF presents with a painful, red right eye
  - Started a couple of days ago, deep boring pain
  - Has tried Visine but hasn’t helped the redness
- PMHx: patient reports she has been diagnosed with rheumatoid arthritis 3 years ago
  - Takes Celebrex for the joint pain
  - Patient reports she occasionally gets a skin rash when she is outdoors in the sun
- POHx: unremarkable
- PMHx: mother has rheumatoid arthritis

Case: Gonzalez

- VA:
  - 20/30 (6/7.5) OD,
  - 20/20 (6/6) OS
- Pupils: PERRL – APD
- VF: FTFCC OH
- EOM’s: FROM OU
- BP: 130/85 mm Hg RAS
- SLE: see picture
  - 2+ cells, mild flare
- IOP’s: 16, 16 mm HG
- DFE: see fundus photo
Rheumatoid Arthritis

- Collagen vascular disorders:
  - most common form of inflammatory joint disease
  - lead to most common form of physical disability in the US
- Average onset between 35-50
- familial predisposition
- 3x more females
- Predominately Caucasian

Epidemiology-Systemic

- Primary sites of infl’ n are centered around musculoskeletal tissues
  - small joints with synovial linings are most commonly affected in hands/feet early in disease
- RA joint characterized by hypertrophic, inflamed synovial tissue with fluid accumulation and adjacent soft tissue swelling
  - this is responsible for hot, swollen, tender joints that are hallmark of RA

Other Diagnostic Criteria for RA

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Cutaneous</th>
<th>Ocular</th>
<th>Pulmonary</th>
<th>Cardiac</th>
<th>Neurological</th>
<th>Hematological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nodules</td>
<td>Sera</td>
<td>Vasculitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
</tr>
<tr>
<td>Epidermitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
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<tr>
<td>Scleritis</td>
<td>Nodules</td>
<td>Vasculitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
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<tr>
<td>Other</td>
<td>Nodules</td>
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<td>Nodules</td>
<td>Vasculitis</td>
<td>Nodules</td>
<td>Vasculitis</td>
</tr>
</tbody>
</table>

Diagnostic Criteria for RA

- Morning stiffness > 30 minutes
- Painful swelling of 3 or more joints
- Involvement of hands and feet (especially MCP and MTP joints)
- Duration of 4 or more weeks
- Differential diagnoses include: crystal arthropathy, psoriatic arthritis, lupus, reactive arthritis, spondyloarthropathies.

Lab Testing for RA

<table>
<thead>
<tr>
<th>Test</th>
<th>Diagnostic Value</th>
<th>Disease Activity Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESR or CRP</td>
<td>Indicate only inflammatory process-Very low specificity</td>
<td>ESR elevated in many but not all active inflammation. May be useful in monitoring disease activity and response to treatment</td>
</tr>
<tr>
<td>RF</td>
<td>RF has a low sensitivity and specificity for RA. Seropositive RA has worse prognosis.</td>
<td>No value</td>
</tr>
<tr>
<td>ANA</td>
<td>Positive in acute RA, SLE, or other connective tissue disorders (CTD)</td>
<td>No value does not reappear</td>
</tr>
<tr>
<td>X-rays</td>
<td>Diagnostic criteria rarely seen in disease &lt;3 mo’s duration</td>
<td>Serial x-rays over many years may show disease progression and indicate medication change</td>
</tr>
<tr>
<td>Joint aspiration</td>
<td>Indicated if infection suspected</td>
<td></td>
</tr>
</tbody>
</table>
**Rheumatoid Factor (RF)**

- RF is an autoantibody directed against IgG
- Most common lab testing are latex fixation and nephelometry
- RF present in 70-90% of patients with RA
  - However RF is not specific for RA
  - Occurs in a wide range of autoimmune disorders
  - Prevalence of positive RF increases with age
    - As many as 25% of persons over age of 65 may test positive
    - High titer for RF almost always reflects an underlying disease

**Antibodies to Cyclic Citrullinated Peptides (anti-CCP)**

- Proteins that contain citrulline are the target of an AB response that is highly specific for RA
- Anti-CCP detected using ELISA
- Associated conditions:
  - Appears to be quite specific for RA
    - Specificity as high as 97%
    - Sensitivity in the range of 70-80% for established RA and 50% for early-onset
  - Has superior specificity and comparable sensitivity for diagnosis of RA as compared to RF

**Diagnosis**

- Joint x-ray and radionucleotide evaluation of suspected inflamed joints are indicated

**Systemic Lupus Erythematosus (SLE)**

- Idiopathic, multisystemic inflammation disorder characterized by hyperactivity of immune system and prominent auto-antibody production
  - against components of cell membranes and nuclear material
- Acute periods followed by periods of remission are common
  - gives disease an unpredictable course

**Epidemiology**

- SLE is not uncommon with prevalence exceeding 1:2000 persons with 85% being female
- Disease may occur at any age though most patients are b/w ages 20-40
  - AA being affected 3x more than any other race (and more severely)

**Systemic Lupus Erythematous (SLE)**

- Definite genetic predisposition has been demonstrated
  - environmental factors also play a role especially as triggers
- Clinical course varies from mild episodic disorder to rapidly developing fatal disease
Epidemiology

- Have to ensure that condition is not secondary to a drug response (several drugs produce lupus-like syndrome)
  - Agents strongly associated include:
    - Procainamide (cardiac arrhythmias), hydralazine (high blood pressure) and isoniazid (anti-tuberculosis)
    - Others include: phenytoin, quinidine, tetracyclines and TNF inhibitors.

Diagnosis

- Based on clinical presentation and lab results
- Systemic features include
  - fever
  - anorexia
  - malaise and weight loss.
- Most patients have skin lesions at some time with the characteristic “butterfly” rash (occurs approx 50%) and often precedes disease manifestations

Diagnosis

- Joint symptoms (with/without active synovitis) occur in >90% of patients and are often the earliest manifestation.
- Other organs affected include heart, kidney, lungs, CNS.
- American Rheumatology Association established 11 criteria for diagnosis (9 clinical manifestations and 3 lab).
  - Minimum of 4 needed serially or simultaneously.

Lab Tests: Antinuclear Antibodies (ANA)

- AB’s directed against nuclear material:
- Detection is via indirect immunofluorescence
  - ANA with titers ≥ 1:40 considered positive
- Associated conditions:
  - Positive tests occur in a wide variety of conditions
  - Low-titer ANA are relatively common among healthy adults

<table>
<thead>
<tr>
<th>Rheumatic Diseases</th>
<th>Organ/Specific AI Diseases</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLE</td>
<td>AI thyroid disease</td>
<td>Drug-induced lupus</td>
</tr>
<tr>
<td>Mixed connective tissue disease</td>
<td>AI hepatitis</td>
<td>Asymptomatic drug-induced ANA</td>
</tr>
<tr>
<td>Scleroderma</td>
<td>Primary biliary cirrhosis</td>
<td>Chronic infections</td>
</tr>
<tr>
<td>Sjogren syndrome</td>
<td>AI cholangitis</td>
<td>Idiopathic pulmonary fibrosis</td>
</tr>
<tr>
<td>RA</td>
<td></td>
<td>Primary pulmonary hypertension</td>
</tr>
<tr>
<td>Polymyositis</td>
<td></td>
<td>Lymphoproliferative disorders</td>
</tr>
<tr>
<td>Dermatomyositis</td>
<td></td>
<td>Type 1 diabetes (ketoadiposis)</td>
</tr>
<tr>
<td>Discoid Lupus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lab Tests: Antinuclear Antibodies (ANA)

- Indications:
  - Very useful initial test when there is clinical suspicion of:
    - SLE,
    - drug induced lupus
    - Mixed connective tissue disease
    - Scleroderma
- Interpretation:
  - Sensitivity of ANA for SLE is very high (>95%)
  - Negative result is very strong evidence against the diagnosis and usually precludes the need to pursue further testing
Lab Tests: Antinuclear Antibodies (ANA)

• Interpretation:
  – Probability of an underlying AI disease increases with the titer of the ANA
  – In an unselected population:
    • Positive test has a predictive value for SLE of 30-40%
    • Negative predictive value for SLE is >99%
  – In proper clinical context a positive ANA provides support for further testing for SLE

Lab Tests: Antibodies to Double-Stranded DNA

• ELISA is most commonly used
• Associated conditions:
  – Occurs in SLE and is rare in other diseases and in healthy persons
• Indications:
  – Should be measured when there is clinical suspicion of SLE and the ANA is positive
• Interpretation:
  – Specificity for SLE is 97% and approaches 100% when titer is high
  – AB’s occur in 60-80% of patients with SLE

“New” Lab Tests

• Anti Sm is found almost exclusively in people with lupus.
  – It is present in 20% of people with the disease
  – rarely found in people with other rheumatic diseases and its incidence in healthy individuals is less than 1%
• Anti-RNP antibodies are commonly found along with anti-Sm antibodies in people with SLE.
  – The incidence in lupus is approximately 25%, while less than 1% of healthy individuals possess this antibody.
• Anti-Ro/SSA and Anti-La/SSB are antibodies found mostly in people with systemic lupus (30-40%) and primary Sjogren’s syndrome.
  – They are also commonly found in people with lupus who have tested negative for anti-nuclear antibodies.

Case

• 55 yr white female complains of fluctuating vision
  – Worse at near
  – Spends 8-10 hours/day on the computer
• Medical Hx:
  – Hypertension for 10 years
  – Joint pain
• Medications:
  – HCTZ for HTN
  – Celebrex for her joint pain

ANA Staining Patterns

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Description</th>
<th>Associated Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral</td>
<td>Anti-DNA (not seen on Hep-2)</td>
<td>SLE</td>
</tr>
<tr>
<td>Homogeneous</td>
<td>Anti-nuclear</td>
<td>RA &amp; SLE</td>
</tr>
<tr>
<td>Specular</td>
<td>Anti-DNA</td>
<td>SLE &amp; S5</td>
</tr>
<tr>
<td>Centromere</td>
<td>Anti-centromere</td>
<td>FSG (CREST)</td>
</tr>
<tr>
<td>Nucleolar</td>
<td>Anti-nucleolar</td>
<td>SLE &amp; FSS</td>
</tr>
</tbody>
</table>

Lab Tests

• Decreased serum complement C1 level is 90% predictive for SLE and C4 is 75%
  – simultaneous presence of both a decreased C1 level and native DNA Ab’s has been been reported to be virtually 100% predictive
• Decreased serum complement levels result from activation and consumption of complement components
Exam Data

- VA (corrected): OD: 20/25, OS: 20/25
- PERRL
- EOM’s: FROM
- CVF: FTFC
- SLE:
  - TBUT 5 sec OD, OS
  - Positive NaFl staining and Lissamine green staining of conj
    and cornea
  - Decreased tear prism

Additional Testing/Questions

- Schirmer: < 5 mm of wetting in 5 minutes OD, OS
- RF and ANA: normal for patients age
- SS-A: 2.0 (normal < 1.0), SS-B: 1.9 (normal <1.0)
- Additional symptoms reported:
  - Patient experiences dry mouth and taking Salagen

- **Diagnosis: Sjogren’s Syndrome**

Differential Diagnosis of Dry Eye

**DED Definition**

“Dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles.”

DED Classification

- **aqueous deficient dry eye (ADDE)** and **evaporative dry eye (EDE)** exist as a continuum, such that elements of each need to be considered in diagnosis and management.
Signs and Symptoms of Dry Eye

**Signs:**
- Ocular Surface Damage
  - Corneal Staining (Fluorescein and/or Rose Bengal)
  - Conjunctival Staining (Lissamine Green)
- Decreased Tear Quantity
  - Schirmer Score
  - Phenol Red Thread Test
  - Tear Meniscus Height
- Decreased Tear Quality
  - Tear Break Up Time (TBUT)
  - Tear Osmolarity

**Symptoms:**
- Grittiness
- Burning
- Irritation
- Stringy discharge
- Blurring of vision
- Ocular Surface Disease Index (OSDI)

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**Treatment**
- We initiated:
  - Omega-3 supplements (2 grams per day)
  - Recommended warm compresses and lid washes qhs
  - Testosterone cream 3% applied to upper lid bid
- Patient had significant improvement in symptoms with the use of the topical testosterone cream.
  - However, she was still symptomatic at the end of the day and she still had significant staining on her cornea and conjunctiva
  - Initiated FML tid for 1 month, Restasis bid after 2 weeks
  - 2 months later patient reported further improvement in her symptoms
    - No conjunctival staining was noted and only slight SPK
    - Schirmer values improved to OD: 9 mm, OS: 10 mm

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**Role of Androgens?**
- Recent studies have suggested that androgen deficiency may be the main cause of the meibomian gland dysfunction, tear-film instability and evaporative dry eye seen in Sjogren patients
- Transdermal testosterone 3% promotes increased tear production and meibomian gland secretion, thereby reducing dry eye symptoms (Dr. Charles Connor).
- Progesterone 0.05%/Testosterone 0.05% Ophthalmic Solution BID (local compounding pharmacy?)
- Topical Testosterone 0.5% drops BID (compounding pharmacy)

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**Sjogrens**
- Chronic AI disease that involves diffuse exocrine gland dysfunction and lymphocytic infiltration throughout the body
- Decreased lacrimal gland secretion results in keratoconjunctivitis sicca, possible pannus/corneal opacification, and possible filamentary keratitis development.
- Decreased salivary gland secretion results in sicca complex (dry mouth)
- Emotional tearing is not affected

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**Sjogren’s Ocular and Systemic**
- Recently published article comments:
  - all patients had dry eye symptoms for approximately 10.4 years before presentation
  - 42% of the patients had systemic manifestations resulting from primary SS
  - SS has been shown to be an independent risk factor for the development of non-Hodgkin’s lymphoma.
Sjogren’s Ocular and Systemic

- Authors recommendation:
  - primary SS is associated with vision- and life-threatening complications
  - presence of SS needs to be explored in patients with clinically significant dry eye because dry eye precedes the occurrence of the systemic manifestations

Dry Eye Summit

- Held in December 2014
  - Combination of optometrists, an ophthalmologist and industry
- Goal:
  - to find a way to encourage optometrists to look for, diagnose and manage dry eye in their patients
  - Come to a consensus on the minimum:
    - 3 questions that should be asked to identify dry eye patients
    - 3 diagnostic tests
    - 3 initial treatments

Consensus on Baseline Management

1. For all patients:
   A. Ocular lubrication
   B. Lid hygiene
   C. Nutrition
2. Topical anti-inflammatories

Dry Eye and Lid Disease?

- It is estimated that 67-75% of patients who have dry eye have some form of lid disease
  - it is often the most overlooked cause for dry eye symptoms
- Important to address the lids in any treatment plans for patients with dry eye

Treatment of MGD

At Home Therapy
- Warm compresses
- Eyelid Scrubs
- Self expression

In-Office Therapy
- Manual Expression
- Off-Label Pharmacotherapy
  - Oral tetracycline/doxycycline
  - Topical Antibiotics - eryth., tobra.
  - Topical Steroids - dexamethasone

Systemic side effects
- antibiotic resistance,
  poor gland penetrance
- risk of cataract, glaucoma, poor gland penetrance

Question

A 50YOWF patient presents with eye pain and the following presentation. What lab testing should be considered first?
Superior Limbic Keratoconjunctivitis (SLK)

- inflammation of the superior bulbar conjunctiva with predominant involvement of the superior limbus
- adjacent epithelial keratitis and a papillary hypertrophy of the upper tarsal conjunctiva.
- association between thyroid abnormalities and SLK

Superior Limbic Keratoconjunctivitis (SLK)

- mimicking disorder has been encountered in soft contact lens (SCL) wearers, typically with exposure to thimerosal-preserved solutions
- middle-aged people and women are predominantly affected
- Much higher prevalence in Graves patients than normal population

Thyroid Gland

- T4 is the major hormone produced but has low activity in stimulating metabolism
  - T3 has a longer half-life, much higher levels of T3 than T4 are in the circulation
  - T4 considered a prohormone and is metabolized primarily in liver (87% of T3 in circulation is formed from T4)
- T3 is 3-4 times metabolically more active than T4

Testing recommendations?

Patients with no symptoms of thyroid disease and no obvious risk factors have a low likelihood of thyroid disease.

In most situations, TSH is the more sensitive indicator of thyroid status. If further thyroid function tests are indicated they can be subsequently added by the laboratory, or the GP usually without the need to retest the patient.

Thyroid Testing Algorithm

Key points about Grave’s disease:

- Most common cause of eyelid retraction
- Most common cause of bilateral or unilateral proptosis.
- More common in women
- Associated with hyperthyroidism in 90% of patients; 6% are euthyroid
- Smoking is associated with increased risk and severity of ophthalmopathy.
Grave’s disease/Thyroid Ophthalmopathy

Clinical signs
• Eyelid retraction- most common sign
• Lid lag
• Proptosis
• Restrictive extraocular myopathy
• Optic neuropathy

Other clinical features:
• Most frequent ocular symptom is pain or discomfort (30%)- often the result of dry eyes
• Diplopia- 17%
• Lacrimation/photophobia- 15-20%
• Blurring of vision- 7.5%