Welcome!
St. Vincent’s CME Event

Primary Care Summer Symposium

Saturday, August 25, 2012
8:00 a.m. – 5:00 p.m.

St. Vincent’s Bryan Auditorium
1 Shircliff Way, 1st Floor, Main Hospital

9 AMA PRA Category 1 Credits™

Dr. Paul J. Chappano, Program Moderator

“Ten Things You Should Know About the Hand and Wrist”
   “Hand Injuries in Athletics”
   – John C. Crick, M.D.

“Hypogonadism and Men’s Health”
   “Diabetes Update”
   – David R. Sutton, Jr., M.D.

“Wound Care for the New Millennium”
   – Geoffrey L. Risley, M.D.

“Parkinson’s Disease” – Ravi Yarlagadda, M.D.

“Pain Relief for Migraine Headaches”
   “Diabetic Neuropathy: Surgical Options”
   – Michael A. Fallucco, M.D.

“Non-Invasive Cardiac Testing” – Mark A. Hayes, M.D.

“The Increasing Incidence of Hepatocellular Carcinoma & Clinical Pearls”
   – Stephen E. Kuehn, M.D.

“Atrial Fibrillation and Surgical Maze”
   – Mark A. Mostovych, M.D.

“Parathyroid Problems”
   – Paul J. Chappano, M.D.

“Foot and Ankle Surgery”
   – Kenneth Cintron, M.D.

Reception immediately following the Conference
5:00 p.m. Cocktails and heavy hors d’oeuvres
CME participants and St. Vincent’s Medical Staff are invited to attend with guest.
Ten Things You Should Know About the Hand and Wrist

John C. Crick, M.D.
• Trigger Finger
• Dupuytren’s Disease
• Carpal Tunnel Syndrome
• de Quervain's
• Gout
• Compartment Syndrome
• Bites
• Infections
• Scaphoid Fracture
• High Pressure Injection Injury
Trigger Finger
(stenosing tenosynovitis)
Trigger Finger

- Often occur in multiple digits
- Common in DM, Dupuytren’s
- may complain of locking at the PIPJ, and may have joint contracture
- tenderness over proximal flexor sheath
- stenosis is usually at proximal pulley
Treatment

- Splint in extension
- NSAIDs
- Steroid injection of sheath (may ↑ glucose in DM)
- Surgical release of pulley
Steroid Injection
Dupuytren’s
Dupuytren’s

- hereditary (northern European background)
- male > female
- Dupuytren’s diathesis-Peyronie’s or foot involvement
- tendency to get other stiff joints, CTS, trigger digits, knuckle pads
Treatment

• Observation if no contracture
• Surgical release
• Collagenase injection
• Splints
Carpal Tunnel Syndrome
Distribution of the Cutaneous Nerves to the Palm and to the Dorsum of the Hand
etiology

- idiopathic
- pregnancy
- injuries (i.e. wrist fractures)
- repetitive motion
- inflammatory arthritis
Treatment

- splint
- Modifications of activities
- B6
- NSAID
- Steroid injection
- Surgical Release (open or endoscopic)
endoscopic release
de Quervain’s Tenosynovitis

Tendonitis of the 1st Dorsal Compartment
de Quervain
Ueber eine Form von Chronischer Tendovaginitis
1895
6 Dorsal Compartments

Ext. Carpi Radiales:
- Longus
- Brevis
(1) Ext. Pollicis Longus
(2) Abd. Pollicis Longus
Ext. Pollicis Brevis

Ext. Digitii V (6)
Ext. Carpi Ulnaris
Ext. Digitorum (5)
Ext. Indicis

Tubercle

Radius
Ulna
Signs and Symptoms

- Pain
- Swelling
- Tenderness
- Crepitus
- Pain with stretch
- Warmth
Finkelstein’s Test
de Quervain’s

- 174 cases in 168 patients
- 22 pregnant or post partum
- Average age 44.0 yrs.
- 146 female (6.6 to 1)
## Results of Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral Anti-inflammatories</td>
<td>14</td>
<td>73</td>
</tr>
<tr>
<td>Splints</td>
<td>9</td>
<td>41</td>
</tr>
<tr>
<td>Steroid Injections</td>
<td>53</td>
<td>46</td>
</tr>
<tr>
<td>Surgery</td>
<td>57</td>
<td>5</td>
</tr>
</tbody>
</table>
Gout

72 year old male
Gout

- Inflammatory response to deposition of monosodium urate crystals
- Uricase deficiency
- Only 30% have elevated serum level at the time of acute gout
- Needle shaped negative birefringent crystals to polarized light
gout presentation

- tendonitis
- acute inflammatory arthritis
- nerve compression
- often single joint
- diuretic medication
- peripheral joints (body temp)
- often looks like infection
treatment

• NSAID
• Colchicine (not preferred tx)
• steroids
• surgery (debulk)
• modify diet and lifestyle
• xanthine oxidase inhibitor (uricostatic)
• uricosuric drugs
Compartment Syndromes

- pain
- pallor
- pulselessness (late)
- puffiness
- paresthesias
- paralysis
etiology

- fractures (pediatric supracondylar, both bone forearm)
- crush injury
- ringer injury
- bleeding, bleeding disorders
- tight cast or dressing
- Saturday night palsy
surgical emergency
pressure measurement
compartment fasciotomy
avoid Volkmann’ contracture
Bites
Dog Bites
Eikenella Corrodens and Staph
Caged bird bites
oral flora

• 40% E coli
• 33% Salmonella (cipro)
• 53% staph species
• 40% pasteurella (augmentin)
• 15% proteus
Cat Bites

- high infection rate - due to sharp, deep puncture wounds
- *pasteurella multocida* (normal flora in 90%), gram negative coccobacillus
- staph
- strept
- anaerobes

pasteurella multocida

- augmentin

- in PCN allergy use doxycycline, tetracycline, ciprofloxacin

- don’t use: 1st generation cephalosporins, erythromycin, clindamycin, aminoglycosides
Human bites (or tooth contact)
Human Bites

• streptococcus pyogenes
• staph aureus
• eikenella corroden (gram negative rod)
sensitive to PCN and ampicillin, but not oxacillin,
methacillin or clindamycin
Non surgical infections *

• soft tissue infection
• local wound infection
• cellulitis
• lymphangitis
Cellulitis
Lymphangitis
Does this infection involve a closed space?
Closed spaces require surgical drainage

- abscess
- septic joint
- flexor sheath (suppurative tenosynovitis)
- deep subfascial spaces
Deep Subfascial Space Infections

- Dorsal Subcutaneous
- Dorsal Subaponeurotic
- Thenar
- Hypothenar
- Middle Palmar
- Interdigital Web
Dorsal Space
Fingertip
Felon    Paronychia
Suppurative Tenosynovitis

- Excessive tenderness over the course of the sheath, limited to the sheath
- Symmetrical enlargement of the whole finger
- Excruciating pain on extending the finger
- Flexion of the finger
Septic Arthritis
Diagnosis: Septic Arthritis

• Warm, swollen, tender joint
• Fever
• Decreased ROM
• Joint held in position to allow max. volume
• Increased WBC (in only 50% of patients)
• ESR, CRP elevated
• Diagnosis with fluid aspirate
Organisms

• Staph Aureus
• Streptococcus
• Eikenella Corrodens
• Pasteurella Multocida
• Pseudomonas
• Serratia
• E. Coli
Osteomyelitis, 9 year old, cat bite
Is there necrotic tissue?
Debridement of dead tissue is required with infections
Necrotizing Fasciitis
patient population

• unemployed
• EtOH
• IV Drugs
• DM
Organisms

• group A - beta hemolytic strep
  (penicillin, clindamycin)
• staph
• mixed aerobes, anaerobes
presentation

• fever (not in all)
• increased WBC
• bullae
• cutaneous hemorrhage
• gas, crepitus in soft tissue
• rapid proximal spread along fascial planes
even with early aggressive surgery the mortality rate is 20%-40%
Scaphoid Fractures
tenderness in “anatomic snuff box”
Diagnosis

• clinical suspicion
• plain radiographs
• CT scan
• Bone scan
• MRI
High Pressure Injection Injuries
Hand Injuries In Athletics

Most athletic activities can produce hand and wrist injuries. The hand is often positioned in advance of the body where it is used to direct and receive the impact of balls, opponents, rigid equipment, or the playing surface. Although hand injuries are frequently generated in contact or collision sports, ball-handling sports produce the greatest number of injuries. In our review of 538 athletic injuries to the hand and wrist treated in Northeast Florida from 1982 to 1994, three sports: football, basketball, and baseball (including softball) accounted for 73% of the injuries with almost equal frequency. Twenty-seven individual sports were represented with the sports most frequently producing hand injuries listed in Table 1. Minor injuries such as abrasions, simple lacerations, contusions, and minor sprains were excluded.

In these sports, 86% of the injuries resulted in fractures, emphasizing the importance of radiographs in evaluation.

Fractures

Phalangeal fractures (Table 2) are the most frequent injury overall and account for one-third of all our injuries. Non-displaced fractures can often be treated with splints or buddy taping to the adjacent digit for 3-4 weeks. Displaced fractures should be reduced. Many intra-articular fractures are not only unstable, but should be anatomically reduced and stabilized surgically.

Metacarpal fractures are usually produced by direct impact (Table 3). The high incidence of metacarpal fractures in baseball is the result of head first slides. Of 28 metacarpal fractures in baseball, 15 (56%) were caused by slides and 5 (18%) were the result of being hit by a pitched ball. In karate and boxing, almost 60% of hand injuries resulted in metacarpal fractures.

Most isolated metacarpal fractures can be treated with casts or splints, but some loss of length may occur with loss of prominence of the metacarpal head. Severely displaced fractures or athletes with multiple metacarpal fractures may be best treated with surgical fixation. As with phalangeal fractures, most angular deformities and all rotational deformities should be corrected. In our series, the high percentage of phalangeal and metacarpal fractures in gymnastics and soccer was the reflection of the younger age of these athletes. In children with open epiphyses, fractures generally occur rather than ligament or tendon disruptions.

Tendon Injuries

Four types of tendon injuries occur in sports (see Table 4, next page). Mallet deformities frequently occur in football, baseball, and some sports. Statistically 61% (22 of 36) of the mallet deformities in this report demonstrated fractures radiographically in addition to the typical drop at the distal joint. Treatment usually consists of splinting the distal joint in full extension with the proximal interphalangeal joint free for 6 to 8 weeks. Close follow-up, however, is important to assure that no joint dislocation or subluxation occurs, and that the splint is worn correctly.

Boutonniere deformities are due to a tear of the central slip at the proximal interphalangeal joint creating a flexion deformity or extensor tendon lag at this joint, which may be later combined with hyperextension of the distal joint in chronic cases. These are the second most frequent closed tendon injury in athletics. Although splinting may occasionally be successful with these injuries, usually surgical repair produces the best results.

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Table 1. Total Injuries 538
Football 138
Basketball 131
Softball/Baseball 125
Volleyball 23
Gymnastics 14
Snow Skiing 13
Martial Arts/Boxing 12
Soccer 11
Tennis 10

Table 2. Phalangeal Fractures

<table>
<thead>
<tr>
<th>Sport</th>
<th>Total Injuries</th>
<th>Phalangeal Fractures</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soccer</td>
<td>11</td>
<td>9</td>
<td>82%</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>14</td>
<td>9</td>
<td>64%</td>
</tr>
<tr>
<td>Football</td>
<td>138</td>
<td>50</td>
<td>36%</td>
</tr>
<tr>
<td>Basketball</td>
<td>131</td>
<td>47</td>
<td>36%</td>
</tr>
<tr>
<td>Baseball/Softball</td>
<td>125</td>
<td>41</td>
<td>33%</td>
</tr>
<tr>
<td>Volleyball</td>
<td>23</td>
<td>6</td>
<td>26%</td>
</tr>
</tbody>
</table>

Table 3. Metacarpal Fractures

<table>
<thead>
<tr>
<th>Sport</th>
<th>Total Injuries</th>
<th>Metacarpal Fractures</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martial Arts/Boxing</td>
<td>12</td>
<td>7</td>
<td>58%</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>14</td>
<td>4</td>
<td>29%</td>
</tr>
<tr>
<td>Baseball/Softball</td>
<td>125</td>
<td>28</td>
<td>22%</td>
</tr>
<tr>
<td>Football</td>
<td>138</td>
<td>20</td>
<td>14%</td>
</tr>
<tr>
<td>Basketball</td>
<td>131</td>
<td>11</td>
<td>8%</td>
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</table>

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Table 4. Closed Tendon Injuries

<table>
<thead>
<tr>
<th>Tendon</th>
<th>Football</th>
<th>Basketball</th>
<th>Baseball</th>
<th>Volleyball</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mallet Fingers</td>
<td>11</td>
<td>11</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Boutonnoire Deformities</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Profundus</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sagittal Fiber Tears</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

The avulsion of the flexor digitorum profundus tendon from the distal phalanx results in an inability to flex the distal joint. Catching a finger in the opponents jersey has resulted in the nickname “jersey finger” for these injuries. They most frequently occur in football. Surgery is recommended.

The sagittal fibers of the extensor mechanism anatomically hold the extensor tendon in its central position over the metacarpophalangeal joint. If torn, these fibers allow the extensor tendon to snap off the metacarpal head and dislocate (see Figure 1A & B).

Dislocations and Fracture Dislocations
The majority of dislocations are produced at the proximal interphalangeal joint. Of 37 injuries, 29 took place at this joint. The majority of these were produced in baseball. In baseball the distal joint may also be dislocated with “ball jam” injuries. Due to the high energy of these injuries secondary to ball velocity \((E=1/2MV^2)\), open dislocations may occur. These require appropriate early surgical treatment for best results (see Figure 2).

Simple dorsal interphalangeal dislocations can often be reduced on the field with gentle hyperextension of the interphalangeal joint followed by traction and flexion. The collateral ligaments should then be evaluated with stress testing and follow-up radiographs obtained. Rarely at the proximal interphalangeal joint and occasionally at the metacarpophalangeal joint, dislocations are irreducible with closed treatment (complex dislocations). This may occur due to entrapment of the ligaments or entrapment between the tendons and lumbral muscles at the metacarpophalangeal joints. Open treatment of these injuries is required.

One of the most serious small joint injuries is a fracture dislocation of the proximal interphalangeal joint (see Figure 3A-D). Many of these are diagnosed late. When seen early, closed reduction may be accomplished unless central comminution from impaction is present. The joint should be anatomically reduced, and the motion started as soon as possible based on the stability of fixation. Disastrous results can occur when these are not treated early and the patient ultimately develops a stiff painful joint. Fracture dislocations should not be confused with simple volar plate avulsion fractures that occur at the base of the middle phalanx. These are undisplaced injuries, and do not demonstrate dislocation of the joint (see Ligament Injuries).

Ligament Injuries
The collateral ligaments and volar (palmar) plate provide stability to side load and hyperextension of the metacarpophalangeal and interphalangeal joints. Anatomic differences in these joints lead to different injury patterns, especially in athletes with open epiphyses. Lesser injuries produce grade 1 or 2 sprains where no gross instability can be demonstrated but more violent injuries may cause complete tears (grade 3 injuries) with loss of structural support and marked angular deformities with stress testing.

The metacarpophalangeal joint of the thumb is the most frequent site of athletic ligament injuries in the hand and accounts for 8% of injuries in this series (41 of 538). These injuries are particularly frequent in snow skiers when the ulnar (medial) collateral ligament is torn by abduction of the thumb. In wrestlers the volar plate may be torn leading to hyperextension instability (see Figure 4A&B). In adolescent ball players, avulsion fractures at the site...
Figure 3A (Top Left). A 17 year old football player presented four weeks after injury, with a painful stiff joint. The lateral radiograph demonstrates an unreduced fracture dislocation of the proximal interphalangeal joint which has now healed in malposition.

Figure 3B (Bottom Left). At surgery the joint and articular surface were reduced, and stabilized with a small lag screw.

Figure 3C, 3D (Right). Extension (top photo) and flexion (bottom photo) of the digit demonstrate excellent motion. This is often not the case when these injuries are seen late.

Figures 4A, 4B (Left). An 18 year old high school wrestler sustained injuries to his right thumb in two different matches. He presented with chronic instability of the palmar plate at the metacarpophalangeal joint. A stress test demonstrates the instability to hyperextension. He was treated surgically at the end of the season.

Figure 5A (Left). A-P radiograph of a 14-year-old middle school football player who sustained an injury to his right thumb in the first game of the season. This Salter-Harris Type III fracture of the proximal phalanx represents an ulnar collateral ligament avulsion at the metacarpophalangeal joint. The fragment usually is rotated by the ligament attachment proximally.

Figure 5B (Below). The fracture (arrow) is opened at surgery. The abductor hood has been split and tagged with sutures.

Figure 5C (Right). The articular surface, and the epiphysis have been anatomically reduced and held with pins. The pins were removed at four weeks and he returned to finish the season.
of ligament attachment usually result from angular deformities rather than an interstitial substance tear and may present with large epiphyseal fractures (see Figure 5A-C). Unstable (grade 3) ligament tears should be repaired for optimal results. Sprains without instability (grade 1 and 2) can often be immobilized for 3-4 weeks until swelling and tenderness have subsided. Occasionally braces or taping may allow players to return much sooner.

More frequent than volar plate ligament tears are avulsion fractures produced at the base of the phalanx. These are found more predominantly in large ball sports such as basketball, volleyball, and football, and are the result of hyperextension or “ball jun” injuries. These can usually be treated with early mobilization and return to play.

**Carpal Injuries**

Scaphoid (navicular) fractures are the most frequent carpal injury. In this series they account for almost 5% of the injuries (24 of 538), compared to 8% in other reports.12 (Table 5) We found that basketball produced the majority of scaphoid fractures. We hypothesize that this is related to the hard playing surface as these injuries are usually produced by a direct fall on the wrist.

When non-displaced, cast immobilization usually leads to healing, although 10 to 12 weeks may be required. If not recognized early, the non-union that develops requires surgery. If tenderness in the anatomic snuffbox is present after a wrist injury, assume a fracture of the scaphoid is present until proven otherwise.

Although the triquetrum is sited as the second most prevalent carpal injury,13 we found that fractures of the hamate were more frequent. These injuries are usually produced during a swing of a club, bat, or racquet. These athletes present with direct tenderness over the hamate in the palm of the hand, pain with grasp, especially in ulnar deviation of the wrist, and occasionally ulnar nerve paresthesias. Often these fractures are not recognized clinically and may only be demonstrated with special radiographic projections or CT scans (see Figure 6A&B). Half of the hamate fractures in this report were in golfers. All but one of the hamate fractures were diagnosed late. As recommended in other reports11,12, these patients were treated with excision of the fractured fragment and were all able to return to their preinjury level of competition.

**Summary**

Athletic injuries to the hand are frequent, particularly in ball handling sports. Injuries may be related to equipment, player contact, playing surfaces, and ball size and velocity. Football, basketball, and baseball produce a similar incidence of most injuries, but with some variations. Tendon injuries occur more frequently in football. Metacarpal fractures, fracture dislocations, and open injuries are more frequent in baseball. Scaphoid fractures occur more often in basketball. An awareness of the types and incidences of these injuries should allow more accurate primary care and early treatment. This allows the most rapid return to athletic participation and the best final outcome.2,10,17

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<table>
<thead>
<tr>
<th>Table 5. Carpal Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sport</strong></td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>Basketball</td>
</tr>
<tr>
<td>Football</td>
</tr>
<tr>
<td>Baseball</td>
</tr>
<tr>
<td>Golf</td>
</tr>
<tr>
<td>Tennis</td>
</tr>
<tr>
<td>Lacrosse</td>
</tr>
<tr>
<td>Skeet Shooter</td>
</tr>
<tr>
<td>Weightlifter</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>
REFERENCES


COMMON SPORTS INJURIES TO THE HAND

John C. Crick M.D.

Extensor Tendon Injuries

Mallet Finger

Treatment: Splint distal joint in extension 6 weeks

Mallet Fracture

Treatment: 1. Splint 6 weeks
2. Surgery if large displaced fragment

Boutonniere Deformity

Diagnosis: Unable to extend PIP joint

Treatment: 1. Surgical repair
2. Splint PIPJ in extension 6 weeks
Flexor Tendon Injuries

Profundus Avulsion (Jersey Finger)
Diagnosis: unable to flex distal joint
Treatment: Surgery (much easier in first 2-3 weeks)

Metacarpophalangeal Joint Injuries

MPJ Dislocation
Treatment: Reduce (see PIPJ)
If irreducible -- may be due to interposed palmar plate and need surgery

Ulnar Palmar Plate
Treatment 1: splint in gentle flexion
2: Surgery if seen late

Collateral Ligament Injuries

Ulnar (as shown) "Gamekeepers" Radial (offensive lineman's thumb)
Frequently have Avulsion Fracture esp. in adolescents

Treatment 1: Surgery (in a serious athlete)
2: Cast 3-4 weeks
Volar (Palmar) Plate Fractures
Treatment: Splint 3-5 days in slight flexion or buddy tape
         Early range of motion

Fracture-Dislocation of the PIPJ
Treatment: 1 Refer early
         2 Surgery or closed redux

Bennett's Fracture
Treatment: Surgery (usually unstable)

Scaphoid Fracture
Diagnosis: 1 Tenderness in anatomic snuff-box
         2 X-ray
Treatment: Cast 10-12 Weeks
         Surgery if displaced
Joint Injuries

PIP Joint

Dorsal Dislocation

Treatment: Reduce by increasing the deformity, then apply traction and gentle flexion.
After reduction test the collateral ligaments if unstable -- surgery
Splint in slight flexion or buddy tape 2-3 weeks to allow palmar plate healing
Testosterone and Hypogonadism in Men's Health
Definition of Male Hypogonadism

“… clinical syndrome that results from failure of the testes to produce physiological levels of testosterone … due to disruption of one or more levels of the hypothalamic-pituitary-testicular (HPT) axis.”

Endocrine Society Guideline (2010)

“… inadequate gonadal function, as manifested by deficiencies in … the secretion of gonadal hormones.”

Production and Regulation of Testosterone

FSH = follicle-stimulating hormone; GnRH = gonadotropin-releasing hormone; LH = luteinizing hormone; T = testosterone.
Regulation of Testosterone in the Eugonadal Male

Normal – Eugonadal

FSH = follicle stimulating hormone; GnRH = gonadotropin-releasing hormone; LH = luteinizing hormone; T = testosterone.

Primary Hypogonadism
Hypergonadotrophic Hypogonadism

- Testicular Dysfunction
- Normal Hypothalamic/Pituitary Function
- Results in
  - Increased LH & FSH
  - Low testosterone
  - Impaired sperm production

FSH = follicle stimulating hormone; GnRH = gonadotropin-releasing hormone; LH = luteinizing hormone.
Secondary Hypogonadism
Hypogonadotrophic Hypogonadism

- Normal Testicular Function
- Hypothalamic/Pituitary Dysfunction
- Results in
  - Low or low-normal LH & FSH
  - Low testosterone

FSH = follicle stimulating hormone; GnRH = gonadotropin-releasing hormone; LH = luteinizing hormone; T = testosterone.
Mixed Primary and Secondary Hypogonadism

- Testicular Dysfunction
- Hypothalamic/Pituitary Dysfunction
- Results in
  - Low or low-normal LH & FSH
  - Low testosterone
  - Impaired sperm production

FSH = follicle stimulating hormone; GnRH = gonadotropin-releasing hormone; LH = luteinizing hormone.

## Causes of Hypogonadism

### Congenital
- Cryptorchidism (8/1000*)
- Klinefelter syndrome & variants (1/400*)
- Kallmann syndrome (1/10,000*)
- Sickle-cell disease
- Defects in androgen receptors

### Acquired
- Radiation Damage
- Obesity
- Testicular trauma
- Mumps orchitis
- Severe systemic illness
- Aging
- Pituitary disorder (tumors)
- Medications (corticosteroids, opioids, alcohol, chemotherapy)
- Autoimmune syndromes

*Incidence in the male population.
## Symptoms and Signs Suggestive of Androgen Deficiency

- Reduced libido and sexual activity
- Decreased spontaneous erections, ED
- Gynecomastia
- Loss of body hair
- Very small or shrinking testes
- Low sperm count
- Poor concentration and memory
- Low bone mass
- Hot flushes/sweats
- Decreased energy
- Depressed mood
- Reduced muscle mass and strength
- Increased body fat, BMI
- Sleep disturbance

Androgen Deficiency in Aging Males (ADAM) Questionnaire

1. Do you have a decrease in libido (sex drive)?
2. Do you have a lack of energy?
3. Do you have a decrease in strength and/or endurance?
4. Have you lost height?
5. Have you noticed a decreased enjoyment of life?
6. Are you sad and/or grumpy?
7. Are your erections less strong?
8. Have you noticed a recent deterioration in your ability to play sports?
9. Are you falling asleep after dinner?
10. Has there been a recent deterioration in your work performance?

If the answer is **YES** to question 1 or 7, or at least three of the other questions, low testosterone may be present.

Endocrine Society Guideline Summary—Diagnosis

History and physical (Signs and symptoms)
Make the diagnosis only in men with consistent signs/symptoms and with unequivocally low serum T levels

Consider measuring T levels in men with certain clinical disorders where prevalence of low T is high, such as
- type-2 diabetes
- moderate to severe COPD
- osteoporosis
- men receiving chronic opioids and glucocorticoids

Measure morning total T (testosterone) levels

280-300 ng/dL TT is considered low T in healthy men

Exclude reversible illness, pituitary disorders (LH+FSH), drugs, nutritional deficiency
These factors can lower testosterone levels transiently

Remeasure to confirm low T (testosterone)

Low total T or free or bioavailable T*

Diagnosis


*Range may vary depending on laboratory that is used
Further Diagnostic Recommendations

Primary Hypogonadism
• Karyotype to rule out Klinefelter syndrome
• Measure LH* and FSH*

Secondary Hypogonadism
• Measure serum prolactin, iron saturation, and pituitary function
• Obtain pituitary MRI* if
  – Severe secondary hypogonadism (TT* <150 ng/dL)
  – Hyperprolactinemia
  – Panhypopituitarism
  – Symptoms/signs of tumor-mass effect
    (headache, visual-field defect, or impairment)

*LH = luteinizing hormone; FSH = follicle stimulating hormone; TT = total testosterone; MRI = magnetic resonance imaging
Total Testosterone
- Free and protein bound
- Normal range = 300-1266 ng/dL*

Free Testosterone
- Normal range = 52-280 pg/mL*
- <50 pg/mL = Lower limit of normal

Bioavailable Testosterone
- Free and albumin bound
- Normal range = 70-320 ng/dL*
- <70 ng/dL = Lower limit of normal

SHBG = sex hormone-binding globulin.
*Range may vary depending on laboratory that is used.
Testosterone Levels Vary by Age

- Although levels vary with age, TT levels between 300 ng/dL and 1000 ng/dL are considered to be within normal range for a healthy adult male; however, both TT and free T may vary depending on the lab that is used.

Conditions with a High Prevalence of Low T (testosterone)

- Type-2 diabetes
- Sellar mass
- Moderate to severe COPD
- Infertility
- Osteoporosis
- Corticosteroid or opioid use
- End-stage renal disease

Conditions Associated With Low T in Men Aged 45 Years and Older

- Diabetes Mellitus
- Obesity
- High Cholesterol
- High Blood Pressure
- Asthma/COPD

COPD = chronic obstructive pulmonary disease.
Case Presentation

- Age: 48
- 5-year history of
  - Hypertension
  - Diet controlled type-2 diabetes
- Gynecomastia
- Medications:
  - Thiazide diuretic
- Testes of 20 mL
- Normal prostate exam

Presenting for:
Fatigue, decreased libido and erectile dysfunction for the past 2 years

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body-mass index</td>
<td>32 kg/m²</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>135/84 mm Hg</td>
</tr>
<tr>
<td>Total testosterone</td>
<td>201 ng/dL</td>
</tr>
<tr>
<td>LH</td>
<td>4.5 IU/L*</td>
</tr>
<tr>
<td>FSH</td>
<td>6.3 IU/L*</td>
</tr>
<tr>
<td>Hemoglobin A1c</td>
<td>6.2%</td>
</tr>
</tbody>
</table>

Q1. What is the next step in this patient’s evaluation?

*Normal ranges for LH: 2-12 IU/L, FSH: 1-12 IU/L
FSH = follicle stimulating hormone; LH = luteinizing hormone.
## Testosterone-Replacement Therapy—TRT Options

<table>
<thead>
<tr>
<th></th>
<th>Buccal*</th>
<th>Gel*</th>
<th>IM injection* (enanthate or cypionate)</th>
<th>Patch*</th>
<th>Pellets*</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>Applied to gum twice daily</td>
<td>Applied topically once daily</td>
<td>Injected every 1-2 weeks</td>
<td>Applied topically once daily</td>
<td>Subcutaneous insertion every 3-6 months</td>
<td>Applied topically once daily</td>
</tr>
</tbody>
</table>

Patients with Certain Conditions May Not Be Right for Testosterone Administration

Very High Risk of Serious Adverse Outcomes

- Metastatic prostate cancer
- Breast cancer

Moderate to High Risk of Adverse Outcomes

- Unevaluated prostate nodule or induration
- PSA > 4 ng/mL (>3 ng/mL in individuals at high risk for prostate cancer, such as African Americans or men with first-degree relatives who have prostate cancer)
- Hematocrit >50%
- Severe lower urinary tract symptoms associated with benign prostatic hypertrophy as indicated by AUA/IPSS* score >19
- Uncontrolled or poorly controlled congestive heart failure

*AUA/IPSS = American Urological Association/International Prostate Symptom Score
<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Each Visit</th>
<th>3-6 Months</th>
<th>Annually</th>
<th>1-2 Years</th>
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<tbody>
<tr>
<td>Symptom response</td>
<td></td>
<td></td>
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<tr>
<td>Adverse events</td>
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<td>Formulation-specific</td>
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<td>adverse events</td>
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<td></td>
</tr>
<tr>
<td>T levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematocrit</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMD of lumbar spine/femoral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>neck†</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DRE</td>
<td></td>
<td></td>
<td>†</td>
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</tr>
<tr>
<td>PSA</td>
<td></td>
<td></td>
<td>†</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If hematocrit is >54%, stop therapy until hematocrit decreases to a safe level; evaluate the patient for hypoxia and sleep apnea; reinitiate therapy with a reduced dose.
†For patients with osteoporosis or low trauma fracture, consistent with regional standard of care.
‡After 3-5 months, perform in accordance with guidelines for prostate cancer screening, depending on the age and race of patient. Obtain urological consultation under certain conditions.

2010 Endocrine Society Guideline—Reasons for Urological Consultation

- Serum PSA concentration >4 ng/mL (>3ng/mL in individuals at high risk for prostate cancer, such as African Americans or men with first-degree relatives who have prostate cancer)
- An increase in serum PSA >1.4 ng/mL within any 12-month period of T replacement
- A PSA velocity of >0.4 ng/mL/yr using the PSA level at 6 months after initiation of T replacement as the reference
  - Only applicable if PSA data are available for a period >2 years
- Detection of prostatic abnormality on DRE
- AUA or IPSS prostate symptom score >19

AUA = American Urological Association; DRE = digital rectal exam; IPSS = International Prostate Symptom Score; PSA = prostate specific antigen.
Testosterone and Hypogonadism in Men’s Health—Summary

- Low T is characterized by subnormal T concentrations (TT <280-300 ng/dL)*
- Symptoms may include changes in sexual desire, mood, body fat/lean mass ratio, energy and secondary sex characteristics
- There is an association of low T with common comorbid conditions such as type-2 diabetes
- TRT can increase hormone levels to normal ranges
- T concentrations, PSA levels, DRE, hematocrit, and BMD should be monitored during TRT
- TRT is contraindicated in men with known, or suspected, prostate or breast cancer

BMD = bone mineral density; DRE = digital rectal exam; PSA = prostate specific antigen; T= testosterone; TRT = testosterone-replacement therapy.

*Range may vary depending on laboratory that is used.
The Multifactorial Pathogenesis of T2DM

Impaired insulin secretion and insulin resistance underlie all other pathophysiologic defects leading to hyperglycemia

- Decreased insulin secretion
- Inefficient glucose uptake (skeletal muscle)
- Increased hepatic glucose production
- Decreased incretin effect
- Increased glucagon secretion
- Increased free fatty acids
- Neurotransmitter dysfunction
- Increased glucose reabsorption

“Diabetes Update”

David R. Sutton, Jr., M.D.