

## Top 10 Occupational Diseases

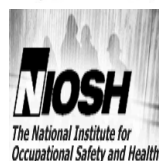
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## Epidemiology of Occupationally Related Medical Conditions



Ohio

Bureau of Workers' Compensation



Occupational Safety and Health Administration  
www.osha.gov

## Top 10 ....

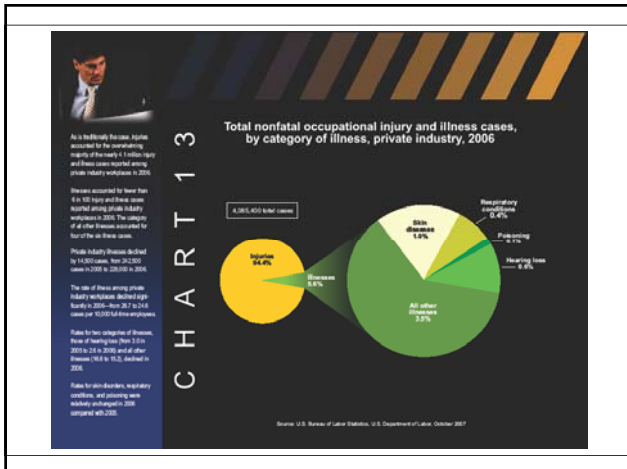
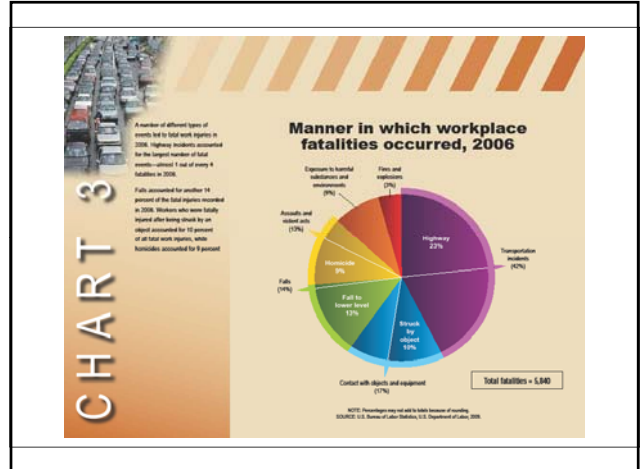
- Noise Induced Hearing Loss
- Occupational Contact Dermatitis
- Occupational Pulmonary Diseases
- Occupational Musculoskeletal Diseases/Eye Injuries
- Bloodborne Pathogen Exposures

## Incidence of Occupational Injuries and Illnesses

- Vast majority of reported occupational medical conditions are musculoskeletal injuries.
- Small minority of reported occupational medical conditions are occupational diseases.
- Most occupationally related diseases are under recognized and underreported.

# Ohio BWC Top 15 Diagnoses for 2009

• Open Wound of Finger, 883.0	13,654 Occurrences
• Sprain Lumbar Region, 847.2	12,803
• Sprain Shoulder/Arm NOS, 840.9	9,186
• Sprain of Neck, 847.0	8,333
• Sprain of Knee & Leg NOS, 844.9	7,126
• Sprain Thoracic region, 847.1	6,228
• Contusion of Knee, 924.11	5,793
• Contusion of Face/Scalp/Neck, 920	5,379
• Sprain of Ankle NOS, 845.00	5,342
• Sprain Lumbosacral, 846.0	5,277
• Sprain of Wrist NOS,	4,394
• Open Wound of Hand, 882.0	3,905
• Contusion of Hand(s), 923.20	3,115
• Contusion of Finger, 923.3	2,646
• Contusion of Elbow, 923.11	2,405



## Population Fractions from Work Related Respiratory Diseases

- Asthma - 15% (total asthma cases)
- COPD - 15%
- Pneumoconioses - 100%
- Tuberculosis - 5%
- Lung Cancer (Men) - 8 to 19%
- Lung Cancer (Women) - 2%
- Mesothelioma (Men) - 85 to 90%
- Mesothelioma (Women) – 23 to 90%

## Epidemiology

- Worldwide -16% of disabling hearing loss in adults is due to occupational noise exposure.
- U.S. – 10 million of the 28 million with hearing impairment have loss caused by noise exposure.
- Second most common cause of hearing loss after presbycusis.

## Noise Induced Hearing Loss



## Definitions

- Noise Induced Hearing Loss – decrease in hearing sensitivity that develops slowly over time (months to years) from continuous or intermittent loud noise exposure.
- Acoustic Trauma – sudden change in hearing due to single exposure to a sudden burst of impulsive noise.
- Presbycusis – progressive, age related hearing loss.

## Categories of Hearing Loss

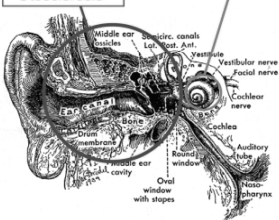
- **Conductive**
- **Sensorineural**
- **Central**
- **Mixed**

## Pathophysiology of Noise Induced Hearing Loss

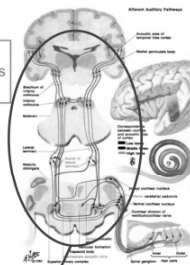
- **Excessive shearing force applied to the stereocilia located on the apical surface of the outer and inner hair cells in the organ of Corti within Scala Media (Cochlear duct) of the cochlea.**
- **Causes destruction of intercilial bridges, collapse of stereocilia, metabolic hair cell damage, and, eventually, hair cell death.**

### Main hearing loss categories

**Conductive**  
eg, Otitis media  
Otosclerosis



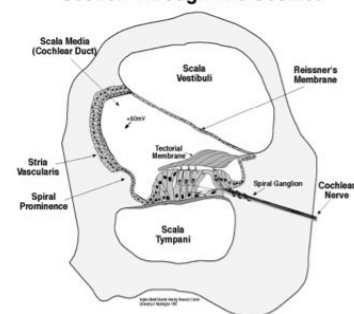
**Cochlear (sensorineural)**  
eg, Noise-induced hearing loss  
Age-related hearing loss



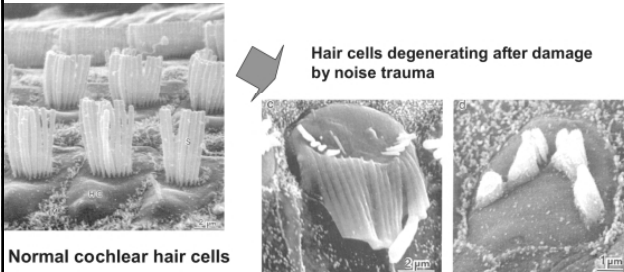
**Central (retrocochlear)**  
eg, Acoustic neuroma  
Auditory neuropathy  
Auditory processing disorder

## Cochlear Microanatomy

### Section Through The Cochlea



## Outer Hair Cells – before & after



Normal cochlear hair cells

Hair cells degenerating after damage by noise trauma

## Common Noise Exposure Levels

• Gunshot (peak level)	140 – 170 dB
• Produces pain	140 – 150 dB
• Jet takeoff (at 20 meters)	130 dB
• Discomfort level	120 dB
• Tractor without cab	120 dB
• Chain saw/ rock concert	110 -120 dB
• Gas weed wacker	100 – 105 dB
• Lawn mower/motorcycle	90 – 100 dB
• Conversation	60 dB

## Noise – How much is too much?

• OSHA Standard –sound pressure level doubles with each 5 dB(A) increase:

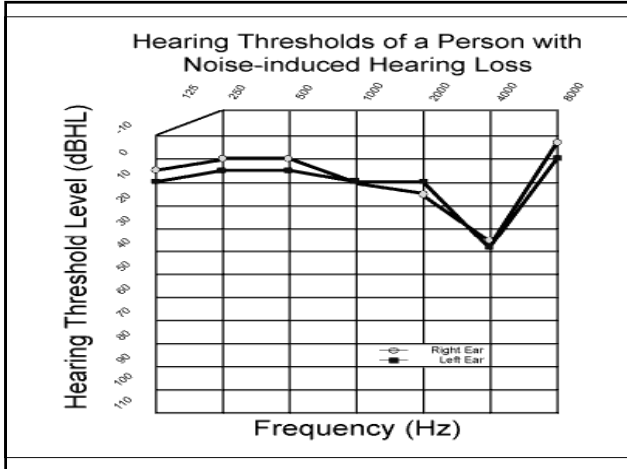
- 85 dB for 16 hours
- 90 dB for 8 hours
- 95 dB for 4 hours
- 100 dB for 2 hours
- 105 dB for 1 hour
- 110 dB for ½ hour
- 115 dB for ¼ hour

• NIOSH Guideline – sound pressure level doubles with a 3 dB(A) increase:

- 82 dB for 16 hours
- 85 dB for 8 hours
- 88 dB for 4 hours
- 91 dB for 2 hours
- 94 dB for 1 hour
- 97 dB for ½ hour
- 100 dB for ¼ hour

## Diagnosis

- Audiometry – determines auditory threshold of perception for pure tones from 250 Hz to 8,000 Hz.
- Can measure both air conduction and bone conduction in each year.
- Noise induced hearing loss is typically a bilaterally symmetric high frequency loss with a peak loss at 4,000 Hz.
- Asymmetric noise sources (sirens, guns) may produce asymmetric losses.



## Noise Induced Hearing Loss Characteristics

- Over years of prolonged noise exposure, noise induced hearing loss expands to involve additional frequencies.
- Rate of hearing loss is greatest during first 10-15 years of exposure and decreases as hearing threshold increases.
- Hearing loss due to noise does not progress (in excess of presbycusis) once exposure is stopped.

## Audiometric Terms

- **Temporary Threshold Shift** - transient increase (hours) in hearing threshold due to temporary hair cell dysfunction.
- **Permanent Threshold Shift** - permanent increase in hearing threshold due to unrecoverable damage to hair cells.
- **Standard Threshold Shift** – 10 dB or greater increase in hearing threshold averaged over 2,000, 3,000, and 4,000 Hz compared to baseline audiogram in one or both ears.

## Additional Characteristics of Noise Induced Hearing Loss

- Previously noise exposed ears are not more noise sensitive to future noise exposure.
- Noise exposure alone usually does not produce a loss over 75 dB in the high or 40 dB in the low frequencies.
- Individual variability in susceptibility.
- Co-exposure to ototoxic agents, including solvents, heavy metals, and tobacco smoke can act in synergy with noise to worsen hearing loss

## Primary Prevention

- No effective treatment, but condition is 100% preventable.
- Engineering Controls – eliminating or isolating noise sources.
- Administrative Controls – limiting exposure times.
- Personal Protective Equipment – ear plugs, ear canal caps, and ear muffs.

## Noise Reduction Ratings (NRR)

- Hearing protective devices have listed noise reduction ratings that range from 20 dB to 40 dB, depending on the device.
- NIOSH recommends that NRR's be derated since labeled NRR's are not reflective of "real world" use, recommending subtracting 25% from earmuffs, 50% from foam and custom molded earplugs, and 75% from all others.

## Hearing Protection Devices



## Occupational Contact Dermatitis



## Epidemiology of Occupational Contact Dermatitis (OCD)

- OCD constitutes 90 – 95% of all occupational dermatoses.
- OCD incidence rates – 5 to 19 cases per 10,000 workers (in most countries).
- OCD period prevalence rates – 6.7 to 10.6 % of workers (in Europe and using hand eczema for OCD).
- OCD ranks first among reported occupational diseases and accounts for up to 30% of compensated occupational disease conditions (in many countries).
- OCD incidence projected to be underestimated by 10 to 50 times (in U.S.).

## Irritant OCD Pathophysiology

- Continuous spectrum of epidermal and dermal cell injury ranging (as classified in one system) from:
  - Corrosion (third - degree chemical burn)
  - Acute Irritation ( second - degree chemical burn)
  - Chronic Cumulative Irritation
  - Phototoxicity
- Acute Irritation and Corrosion
  - due to strong acids, alkalis, oxidizers, or reducers
  - causing significant epidermal disruption, prompting release of proinflammatory cytokines.
- Chronic Cumulative Irritation
  - due to mild irritants, chronic friction, and repetitive microtrauma causing low grade disruption of the stratum corneum, loss of cellular cohesion, desquamation, and increased transepidermal water loss.
- Phototoxicity
  - due to tar and furocoumarins with phototoxic chemical binding to tissues and light activated release of free radicals.

## Types & Distribution of OCD

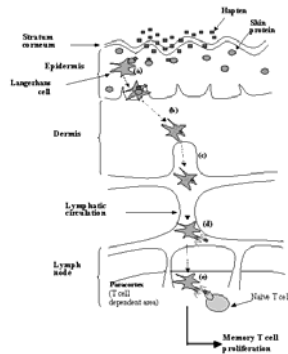
- Irritant Contact Dermatitis - direct cytotoxic effect of a chemical or physical agent on the cells of epidermis and dermis.
- Allergic Contact Dermatitis - delayed-type (cell mediated) hypersensitivity reaction.
- Contact Urticaria - subtype of contact allergy caused by immediate type (IgE mediated) hypersensitivity reaction.
- Distribution - traditionally held that OCD is 80% Irritant and 20% Allergic, but distribution varies by geography and industry from range of 36 – 80 % Irritant to 20 – 60% Allergic.

## Allergic OCD Pathophysiology

- Sensitization Phase
  - small (<500 D), lipophilic molecules pass through stratum corneum and are processed by the antigen presenting cells, which travel to regional lymph nodes and present to naïve T cells, which then proliferate and differentiate into memory and effector cells.
- Elicitation Phase
  - reexposure to allergen stimulates sensitized T cells to release lymphokines inducing proliferation of cytotoxic T cells and attracting macrophages which effects epidermis within 48 to 96 hours to produce clinical dermatitis.



## Allergic OCD Immunogenesis



## Clinical Presentation

- OCD presents as eczematous rash over 90% of time:
  - **Acute lesions** - erythematous, edematous plaques with vesicles and bullae and clear serous exudate.
  - **Subacute lesions** - erythematous, edematous plaques with vesicles gradually replaced with erosions, oozing, crusting, and desquamation.
  - **Chronic lesions** - grayish, thickened, rough, fissured, and accentuated skin lines (lichenified).
- Hands are involved in 80 % of OCD cases.
- Irritant Contact Dermatitis remains localized to exposed area, while Allergic Contact Dermatitis may spread to distant sites.

## Diagnosis

- **Corrosion, Acute Irritant OCD, and Phototoxicity**
  - clinical diagnosis based on presentation of significant erythema, vesicles/bullae, and burning discomfort in sharply demarcated area within minutes to hours of exposure.
- **Chronic Cumulative Irritant OCD**
  - diagnosis of exclusion since there is no diagnostic test.
  - no reliable clinical features to differentiate exogenous Irritant Contact dermatitis from endogenous dermatitis.
- **Allergic Occupational Contact Dermatitis**
  - “Gold Standard” for diagnosis is patch testing.
  - however, has been reported that patch test sensitivity and specificity is 70% with a 50% relevance for positive tests.

## Patch Testing

- Approximately 400 standardized allergens available
  - T.R.U.E. Test – 23 allergens in prepackaged kit.
  - North American Standard Series – 50 allergens.
- Requires 3 visits at 48 hour intervals
  - Day 0 - allergens applied to rows of chambers affixed to patient's back.
  - Day 2 – location of panels marked, panels are removed, and reactions noted.
  - Day 4 – reactions noted again.
- Reactions graded as 0 (no reaction), ? (doubtful), + (Weak), ++ (Strong), and +++ (Extreme).
- Irritant reactions occur early and fade.

## Mathias Criteria for OCD Diagnosis

- 4 out of 7 needed to establish OCD diagnosis.
- Clinical appearance consistent with contact dermatitis.
- Workplace exposure to allergens or irritants.
- Anatomic distribution consistent with job exposure.
- Temporal relationship between exposure and onset.
- Non-occupational sources excluded.
- Improvement away from work.
- Patch or provocation tests identify a probable cause.



## Common Occupational Irritants and Allergens

- Irritants
  - Acids and alkalis
  - Oxidizing biocides
  - Epoxy catalysts
  - Soaps, detergents, solvents, and water
  - Sand, sawdust, metal filings, and fiberglass
- Allergens
  - More than 3,700 known cutaneous allergens.
  - Potassium dichromate
  - Epoxy resin
  - Rubber accelerators/antioxidants
  - Para-phenylenediamine (cosmetics)
  - Penta- and heptadecylcatechols (poison ivy)

## Treatment and Prognosis

- **Treatment**

- Prevention of further exposure.
- Saline/Burrows wet to dry dressings.
- Topical/ systemic corticosteroids.
- Emollients
- Antihistamines

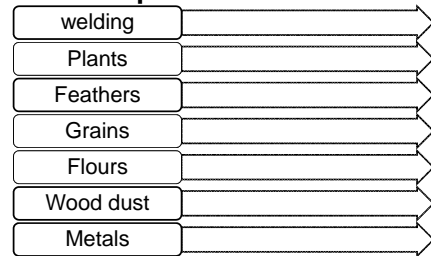
- **Prognosis**

- Recovery <50% in reviews prior to 1990.
- Recovery of ~80% more recently.

## Occupational Medicine Pulmonary Diseases

- Occupational asthma

- ✓ Associated exposures:

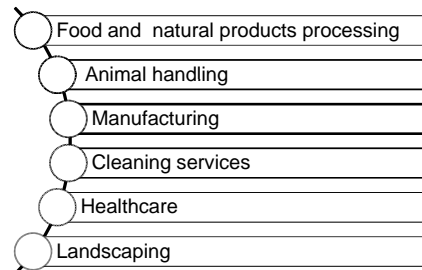


## Top 10 Occupational Medicine Diseases

- Occupational pulmonary Diseases.
- Occupational musculoskeletal injuries/Eye. injuries.
- Occupational needle and blood borne pathogens

## Occupational Asthma

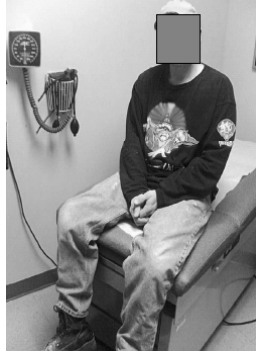
- Industry sector:



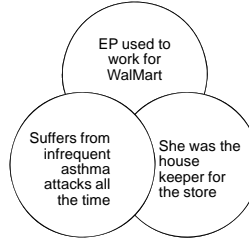
# Occupational Asthma

Case study:

WR is a construction worker  
Continues to work despite adversities regarding his health  
He is currently working with a contractor under the table  
He is assigned to put in false ceilings and tear down an old building  
Exposure: ?  
Diagnosis:  
Occupational Asthma



# Occupational Asthma



# Mold



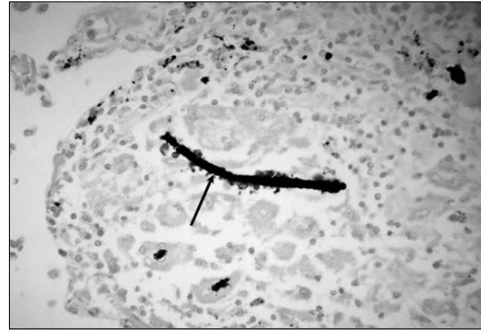
# Cleaning supplies



## Occupational Pulmonary Diseases

- Inorganic dust diseases:
  - ✓ Asbestosis
  - ✓ Coal workers pneumoconiosis
  - ✓ Silicosis
- Organic dust diseases:
  - ✓ Byssinosis
  - ✓ Hypersensitivity pneumonitis

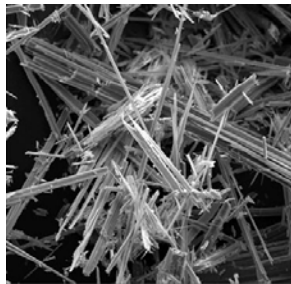
## Asbestosis: Amphiboles are markedly more carcinogenic because their straight shape



CDC

## Occupational Pulmonary Diseases

- Asbestosis:
  - ✓ Asbestosis caused by inhalation of microscopic fibers of asbestos.



## Asbestosis:

Asbestos is a mineral fiber that was added in the past in certain products.

Homes built before 1978

Insulation blankets with tape around steam pipes, boilers, Furnace ducts

Resilient floor tiles.

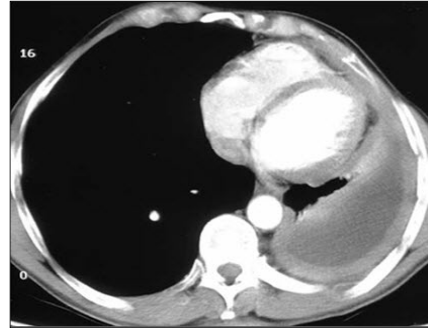
Installation made of cement, sheet metal board, paper used around furnaces and wood burning stoves

## Asbestosis

Corticosteroids and immunosuppressive drugs does not alter the course of the disease.



## Mesothelioma

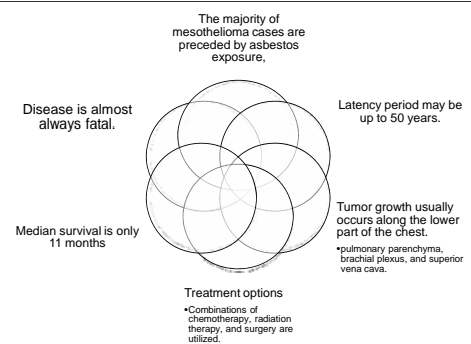


The computed tomography scan shown is of a 58-year-old patient who presented with shortness of breath and was found to have mesothelioma with extensive pleural thickening, effusion, and lung volume reduction in the affected hemithorax.

## Asbestosis

- Removal of asbestos containing materials should be undertaken by specially trained contractor.
- Mesothelioma, a rare cancer chest lining is caused by asbestos exposure

## Mesothelioma



## Coal Workers Pneumoconiosis

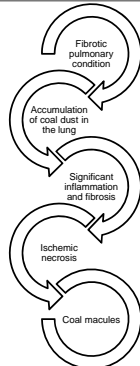
Coal workers pneumoconiosis caused by inhalation of coal dust

- Commonly known as black lung disease
- Scarring of the lung with permanently damaging the lung
- Associated with shortness of breath
- 2.8% of coal miners have coal workers pneumoconiosis

## Coal Workers Pneumoconiosis

- Degree of fibrosis is related:
  - ✓ Duration of exposure
  - ✓ Age at first exposure,
  - ✓ Quantity of inhaled silica within the coal dust
- Asymptomatic but may eventually report productive cough and dyspnea.
- Treatment is supportive and preventative
- Mortality is related to the degree of fibrosis and oxygen requirement.

## Coal Workers Pneumoconiosis



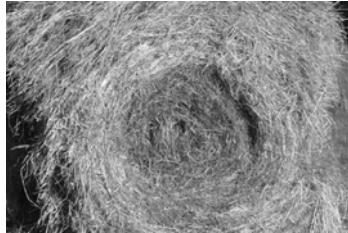
## Hypersensitivity Pneumonitis:

- Hypersensitivity pneumonitis is caused by inhalation
  - ✓ Fungal spores from moldy hay
  - ✓ Bird droppings and other organic dust
  - ✓ Disease is characterized by inflamed air sacs or alveoli leading to fibrous scarring and abnormal breathing
  - ✓ Also named as farmer's lung, Mushroom workers lung, Bird fancier's lung

## Hypersensitivity Pneumonitis:



Moldy hay



Variety of different birds  
Pigeons,  
Pheasants  
Turkeys  
Geese, and  
Parakeets

## Hypersensitivity Pneumonitis

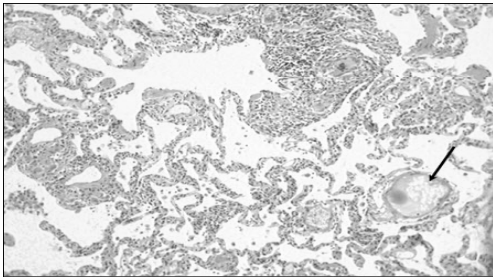
Extensive fibrosis with honeycombing and air-trapping in chronic HP



Fibrosis with honeycombing

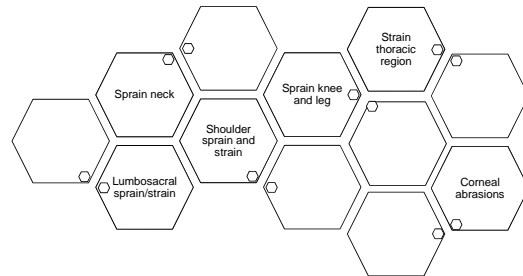
## Hypersensitivity Pneumonitis

cell-mediated immune response that causes extensive inflammation and fibrosis



## Occupation Medicine

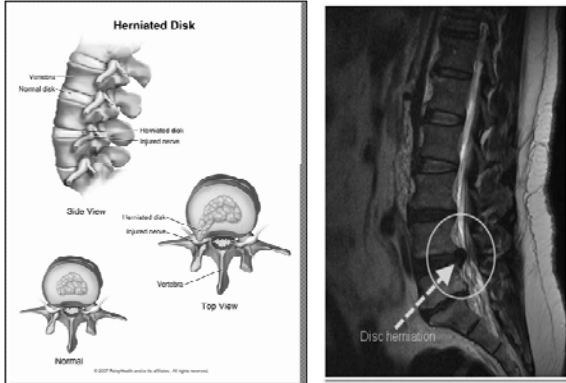
### Musculoskeletal Injuries/Eye injuries



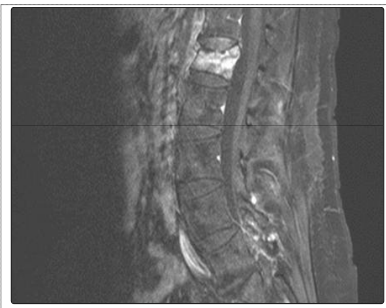
Ohio Bureau of workers compensation:  
2009 Top 25 occurrences by diagnosis



# Herniated Disc



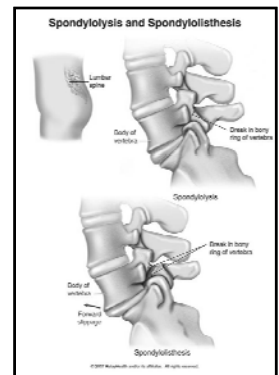
# Work-related Injuries: Compression Fractures



Significant degenerative disc disease can cause compression fractures.

# Spondylolisthesis and Spondylolysis

Spondylolisthesis refers to the forward slippage of one vertebral body with respect to the one beneath it



## Spondylolisthesis

MRI showing spondylolisthesis

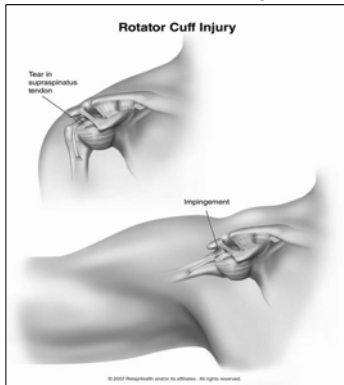


Shoulder injuries after work related accidents in a 74 year old laundry worker

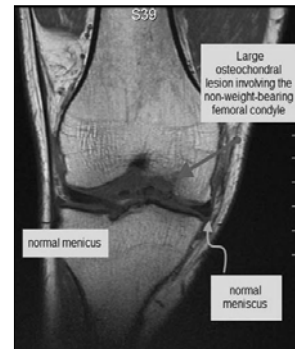
Significant rotator cuff injuries involving all rotator muscles



## Shoulder Injuries



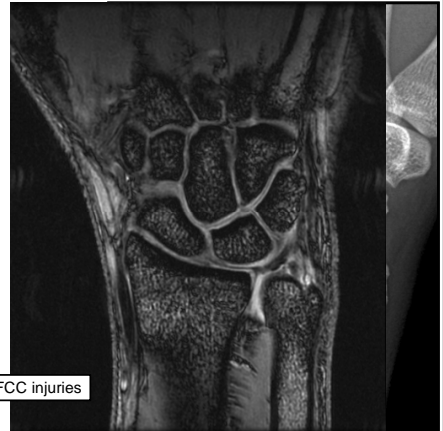
## Knee Injuries



**Impaction fractures  
of the knee..**



Hand Trauma with TFCC injuries



Hand Trauma with TFCC injuries



Hand Trauma with TFCC injuries



## Red eye...

Patient was noted to have  
redeye associated with

Photophobia

Watery Eye

He thinks it's a pinkeye

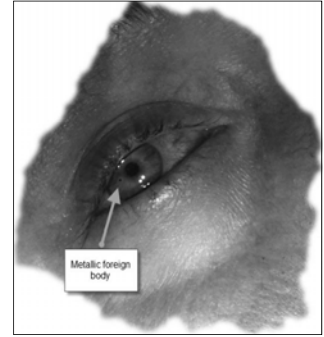
He's unable to work at this point

He tried to go to work this  
morning but was sent to our  
clinic for further assessment.

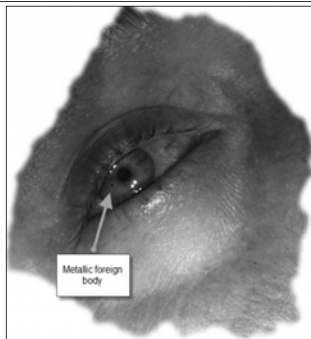


## What Else is Visible Under the Red Eye

Metallic  
foreign  
body

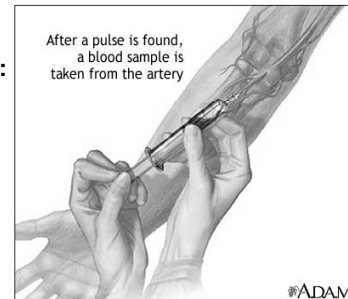


## What Else is Visible Under the Red Eye



## Occupational needle and blood borne pathogens

- Blood borne pathogen exposures:
- HIV
- Hepatitis C
- Hepatitis B
- Effective treatments are available for HIV and Hepatitis B and C infections



Occupation	Documented transmission	Possible transmission
Nurse	24	35
Clinical lab tech	16	17
Physician	6	18
Nonclinical lab tech	3	0
Surgical technician	2	2
Health aide	1	15
Housekeeper	2	13
Dialysis technician	1	3
Respiratory therapist	1	2
Embalmer/morgue tech	1	2
Emergency med tech	0	12
Other tech/therapist	0	9
Dentist/dental worker	0	6
Other HCWs	0	5

Data from the Centers for Disease Control and Prevention. <http://www.cdc.gov/nclidod/hip/BLOOD/hipersonnel.htm>. Accessed on Feb. 19, 2004.

