Osteoarthritis (Degenerative Joint Disease)

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Purpose The purpose of this course is to explain the pathophysiology, causes and risk factors, diagnosis, clinical manifestations, and treatment options for osteoarthritis.

Goals Upon completion of this course, the healthcare provider should be able to:

- Describe the basic anatomy of a synovial joint.
- Describe the pathophysiology of osteoarthritis (OA).
- Describe at least 6 causes and risk factors for development of OA.
- Describe diagnostic procedures related to OA.
- Discuss 3 types of clinical manifestations of OA.
- Discuss 3 types of oral medications used to treat OA.
- Discuss the use of intraarticular injections.
- Describe at least 4 additional treatments.
- Describe surgical options.
- Describe the proper use of a cane.
- Describe at least 4 preventive measures.

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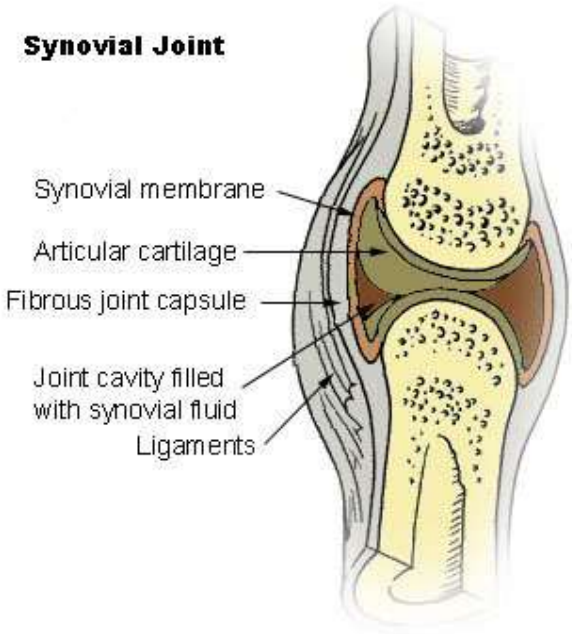
Introduction



Arthritis is a growing health concern in the United States as the population ages. Arthritis is currently the most common cause for disability.

Osteoarthritis (OA), also referred to as degenerative joint disease, is the most common form of arthritis. OA is a slowly progressive non-inflammatory degenerative disease of synovial (diarthrodial) joints. Synovial joints are freely movable and include plane joints, hinge joints, pivot joints, condyloid joints, ellipsoidal joints, saddle joints, and ball-and-socket joints.

The articular surfaces of the bones are covered by hyaline cartilage and are separated by a joint cavity, allowing freedom of movement. The cavity of the joint is lined by a synovial membrane (synovium) and lubricated by viscous synovial fluid. Some joints, such as the knee, contain articular disks or wedges of fibrocartilage between the articular surfaces of the bones.

While OA is not considered a normal process of aging, it is associated with aging because 90% of people show osteoarthritic changes in weight-bearing joints by age 40, with changes in cartilage often evident before age 30. Few people exhibit symptoms prior to age 60, but about 60% of those over 65 exhibit symptoms.

Approximately 40 million people in the United States have OA. Incidence is higher in males than females (2:1) prior to age 50 but reverses after age 50 with incidence in females double that of males, probably because of changes in hormones after menopause.

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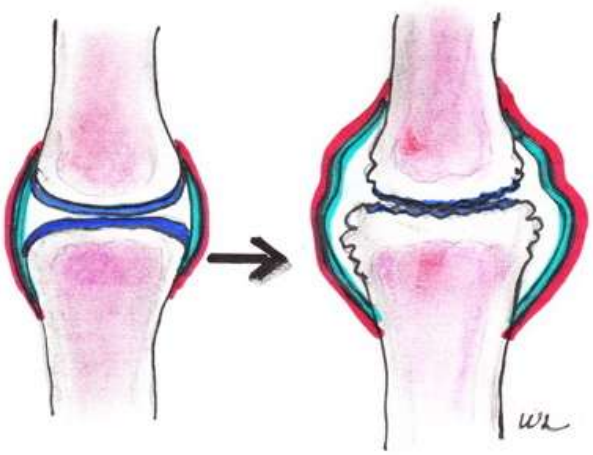
Pathophysiology



Chondrocytes are cells that produce and maintain cartilage. With OA, when cartilage damage occurs, it triggers a metabolic response at the level of the chondrocytes. Cartilage, which is usually white, smooth and translucent, becomes yellowed and granular.

The cartilage begins to deteriorate, becoming softer and less elastic. The body is not able to repair damaged cartilage fast enough to keep up with deterioration. The cartilage begins to fissure and erode, resulting in increased cartilage and osteophytes (bony outgrowths) at the joint margins where the cartilage has attempted to regenerate. Eventually, the cartilage is so eroded that bone rubs against bone (eburnation).

The joint capsule and synovial membrane (synovium) begin to thicken and enlarge and the subchondral bone plate also thickens, increasing the size of the joint. Subarticular bone cysts may develop in the bone. Because the bones no longer articulate properly, there is uneven stress on the joint and reduced mobility.

Sometimes small pieces of cartilage are torn from the joint surface, and these may cause an inflammatory reaction as the body tries to absorb these particles. This inflammatory response may cause some of the early pain and stiffness in joints while later pain occurs primarily because of eburnation.

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Causes and risk factors

OA may occur as an idiopathic (sometimes referred to as primary) or secondary disorder. The cause of idiopathic OA is unknown, but secondary OA is caused by injury or conditions that damage the cartilage or cause instability of the joints.

Direct trauma	Fractures or dislocations of the joints may lead to avascular necrosis or unbalanced stress on the cartilage.
Repetitive stress	Physical activities that result in repetitive mechanical stress on the joints (such as contact sports, keyboarding, piano playing) may cause damage to the cartilage. Jobs or activities that

	require frequent bending or carring of heavy loads ,au omcrease the risk of developing OA in the knee.
Inflammation	Local inflammation may result in release of enzymes that damage the cartilage.
Neurological disorders	Neurologic disorders (Diabetic neuropathy, Charcot joint) may cause pain and loss of reflexes that result in abnormal movement that can cause deterioration of the cartilage.
Unstable joint	Damage to supporting ligaments and tendons may result in joint instability, resulting in unbalanced stress on the articular surfaces and cartilage.
Deformities	Congenital or acquired skeletal deformities, such as congeital subluxation-dislocation of the hip, acetabular dysplasia, Legg-Calvé-Perthes disease, and slipped capital femoral epiphysis) may place increased stress on the joints and damage cartilage.
Hemophilia	Chronic hemophilia is associated with cartilage deterioration.
Drugs	Some drugs, such as corticosteroids, colchicine, and indocin, stimulate collagen-digesting enzymes in the joint synovium.
Obesity	Increased weight places stress on the joints, resulting in damage to the cartilage.

Diagnosis

Diagnosis is by physical examination and assessment, CT scan, MRI, and/or x-ray. However, only about 30% of those with changes seen on imaging report symptoms. CT scan and MRI are especially valuable for early diagnosis because they are sensitive to small articular changes while x-rays may confirm and monitor progress of the disease.

Severe osteoarthritis and osteopenia of the carpal joint and 1st carpometacarpal joint.	

	James Hellman, MD, WC
Hallux varus with osteoarthritis of the base of the great toe.	 Al Kaissi et al, WC
Osteoarthritis of the left knee with narrowing of the joint, osteophytes, and increased subchondral bone density (at arrow).	 James Hellman, MD, Wikimedia Commons

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There are no laboratory abnormalities consistent with osteoarthritis. The erythrocyte sedimentation rate (ESR) is usually within normal limits but may elevate slightly with acute synovitis. Synovial fluid analysis may help to differentiate OA from other forms of arthritis. With OA, the synovial fluid should remain clear and pale yellow without signs of inflammation.

Synovial fluid white cell counts	
Non-inflammatory	<2000 WBC/mcL
Inflammatory	2000 to 75,000 WBC/mcL
Purulent	>100,000 WBC/mcL

Clinical manifestations

OA occurs most frequently in weight-bearing joints (such as the knees, hips, and cervical and lumbar spine), but the proximal and distal finger joints are also commonly affected. There are no systemic manifestations of OA, unlike rheumatoid arthritis. Because most OA is secondary, OA usually manifests asymmetrically, unlike rheumatoid arthritis:

- **Base of the thumb:** Incidence is most common in women over 40 and relates to previous injury.
- **Fingers**: Nodules form about the proximal interphalangeal and distal interphalangeal joints.
- **Wrist**: Associated with pain, limited mobility and weakness (reduced grip strength), swelling may cause compression neuropathy and can lead to carpal tunnel syndrome.
- **Elbow**: One of the least affected joints because it is not weight bearing, but previous injury or fracture may lead to OA.
- **Shoulder:** OA of the shoulder is rare but may result from injury to the joint.
- **Spine**: Degenerative changes are most common in the cervical and lumbar areas. The intervertebral areas narrow and bone spurs may develop.
- **Feet**: The feet lose cushioning with age, becoming less flexible and elastic. The foot widens and muscles weaken, increasing inactivity and disability. Flat feet or high arch also increase risk.
- **Hip and knee:** Weight-bearing joints are prone to OA.

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Pain	Pain varies widely and is often quite mild in the beginning, occurring after activity, but over time pain may also occur at rest. This pain may worsen with changes in barometric pressure. Pain is usually localized in the beginning but may be referred as OA progresses. Pain results from a variety of factors, including synovial inflammation, stretching of joint capsule or ligaments, irritation of nerve endings by osteophytes, trabecular microfracture, bursitis, tendinitis, muscle spasms, and intraosseous hypertension.
Stiffness	Stiffness is more common after periods of rest, such as on first arising in the morning. Initially this stiffness lasts no more than 15 minutes, but this time extends with severity of disease. However,

	morning stiffness usually begins to lessen in about 30 minutes even in more advanced OA. Overactivity that stresses a joint, causing mild effusion. may also contribute to transient stiffness. Another cause of stiffness is loose cartilage particles within the joint. These may result in crepitation (crackling) on movement.
Deformity	Certain deformities are characteristic of OA, including Heberdeen's and Bouchard's nodes on the fingers. Heberdeen's nodules occur on the distal interphalangeal (DIP) joint and Bouchard's on the proximal interphalangeal (PIP) joint. With OA of the knee, the knee joint may become misaligned, resulting in a varus (bowlegged) appearance and abnormal gait.

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	 OA of the hip often causes a shortening of that leg on the affected side, causing the person to walk with a limp.

Treatment options

No treatment if available to halt the degenerative process once it has begun, but some treatment options can slow progress in the early stages of the disease.

OA treatment options	
Medications (oral)	Medications are used primarily to relieve pain in order to increase mobility: • **Acetaminophen** (Tyelenol®): Usually the firstline drug, especially for those at risk of GI bleeding. People may take up to 1000 mg every 6 hours (not to exceed 4 g in 24 hours). • **NSAIDs** (such as ibuprofen and naproxen) or traditional Cox-2 inhibitors: Studies show these drugs are more effective for severe pain than acetaminophen; however, they are associated with increased risk of GI bleeding. NSAIDs are usually started at 200 mg up to 4 times daily and dose increased as necessary. • **Selective COX-2 inhibitors** (such as celecoxib): May be used if other drugs are

	not tolerated but are associated with increased cardiovascular risk.
Intraarticular injections	Corticosteroid injections into a joint may provide relief of acute pain and stiffness for weeks to months: • **Methylprednisolone acetate** (Depo-Medrol®) or t**riamcinolone** (Aristospan®). People may experienced increased pain immediately after the injection, but his usually subsides by the next day. People should avoid overuse for the first 24-48 hours after injection. Injections can safely be given up to 4 times a year.If there is no relief after 4 or more injections, then other treatments should be considered. • **Hyaluronic acid** (HA) (Orthovisc®, Synvisc®, Artz®, and Hyalgan®): HA is usually administered in 3 weekly injections and provides anti-inflammatory and lubricating effect. This may be effective for short-term relief of moderate pain.
Rest/Joint protection	Resting the joint in the presence of increased pain and inflammation is especially important. The joint may be maintained in functional position by splints or braces for up to a week to reduce inflammation, but longer periods should usually be avoided as increased stiffness may occur. Modifying activities to avoid stressing the joint and/or using assistive devices, such as a cane or walker, may help relieve stress on joints. Many braces are available in multiple sizes over-the-counter, but some people may be fitted with custom-designed braces. A brace can assist with stability and function. Two types of knee braces include an "unloader" brace, which shifts load away from the affected portion of the knee and a "support" brace, which helps support the entire knee load. **Unloader knee brace**

	 Support knee brace Studies show these braces result in decreases pain on weightbearing and the ability to walk longer distances. These braces are worn consistently as opposed to shortterm bracing for inflammation.
Heat/Cold	Heat is more commonly used to relieve pain and stiffness than cold, which may relieve discomfort better if a joint becomes inflamed. Heat treatments include warm baths, hot packs, and whirlpool. Heat or cold is usually applied for 20 to 30 minutes at a time with at least an hour between treatments.

Complementary therapy	A wide range of complementary therapies, including acupuncture, acupressure, yoga, and massage, are used to relieve pain and stiffness. Guided imagery and progressive muscular relaxation have proven in studies to reduce pain and stiffness, so people with OA should be taught these simple techniques.
Moderate physical activity	Moderate activity, such as walking, hydrotherapy, Tai Chi) may help retain functional ability without further damaging affected joints and may also contribute to weight loss. Strengthening exercises may help the muscles support the joints more effectively, especially with spinal osteoarthritis. Range of motion exercises may help people maintain flexibility.
Weight reduction	For those who are obese, losing weight may help to relieve stress on the affected joint.
Topical analgesia	Capsaicin cream 0.025 to 0.075 applied 3 to 4 times daily may reduce pain, especially in the knee.
Surgical intervention	Total hip and knee replacement surgeries are effective in relieving pain and discomfort although they are invasive and require, in many cases, extended physical therapy, so they usually done when OA is more advanced and severely impairing mobility. Arthroscopic surgery on the knee has not proven effective in relieving symptoms.

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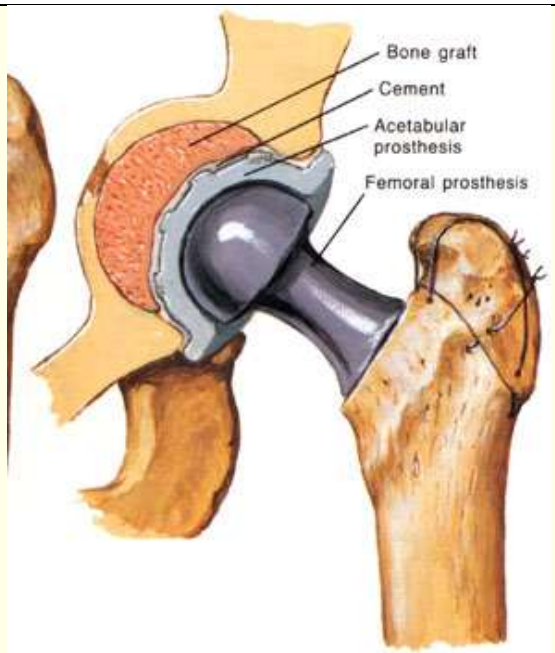

About 773,000 Americans have hip or knee replacement surgery each year.

In some cases, osteotomy may be done reduce pressure on a joint. A wedge of bone is removed near a joint (such as from the tibia near the knee) to shift body weight away from damaged cartilage.

Shoulder joint replacement is less common, about 23,000 each year, but is being done more frequently for those with bone-on-bone OA.

Deformities of the thumb or fingers may require removal of arthritic bone and joint reconstruction, fusion, and/or bone realignent.

Spinal OA is usually treated conseratively, but in some cases, especially if spinal stenosis occurs, surgery may be performed to remove bone spurs or shave damaged cartilage. Sometimes spinal implants may be inserted.

	 Most procedures are now done arthroscopically.
Glucosamine & Chondroitin sulfate	Glucosamine is a natural substance in the body that stimulates formation and repair of cartilage. Chondroitin sulfate is also a natural substance that prevents body enzymes from degrading buiilding blocks of cartilage. Both supplements are developed from animal sources. While studies have not shown that these substances (often taken together) slow the progress of OA or restore cartilage, some studies do show that people report relief of pain and stiffness. These supplements are relatively benign although they should be used with caution in diabetics and pregnant women. because they are not regulated by the FDA, quality may vary considerably.

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Home management

Unless people are undergoing joint replacement surgery, most management of OA is in the home environment, so people must be taught how to manage pain and disabilities. Both home and work environments may require modification for safety reasons. Measures include:

- Removing scatter rugs.
- Placing rails on stairways.
- Providing safety bars in the shower/tub.
- Using night lights.

People may be advised to use assistive devices, but most people use them incorrectly; for example, many people use the cane on the wrong

side, so people should be observed using these devices and instructed in proper use.

Proper use of a cane

The cane should be held on the side opposite the damaged joint. For example, if the person has OA in the right knee, the person should hold the cane by the left hand. Using the cane on the affected side may result in unstable gait.

With the person standing, the cane should normally reach the level of the waist, but this may vary slightly from one individual to another. With the cane forward, the arm should be flexed no more than 20° because if the arms is flexed too much, the elbow cannot lock to provide support and prevent a fall.

Walking:

- Lift the affected leg and the cane and move them forward together at the same time so that the person can relieve pressure on the joint by applying weight to the cane when stepping down and advancing the other foot.
- Hold the cane close to the body.

Stairwalking (Always hold onto stair rail with free hand!):

- **Going up:** (Lead with the good leg.) Unaffected leg first, then cane and affected leg.
- **Going down:** (Follow with the good leg.) Cane first, affected leg, then unaffected leg.

People may benefit from physical therapy and occupational therapy to help them determine what type of exercises are most beneficial and to assist them with environmental modifications.

Conclusion

The best treatment for osteoarthritis still remains prevention. There are a number of steps people can take to prevent deterioration of cartilage in synovial joints:

- Maintain an optimal body weight. A 5-pound weight loss decreases stress on the knee joints by 20 pounds.
- Exercise regularly but avoid repetitive stress and contact sports.
- Eat a nutritional diet.
- Protect joints from stress by using proper body mechanics and avoid excessive kneeling, squatting, and gripping.

However, even people who are proactive in preventing osteoarthritis cannot protect themselves completely.

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