



THE UNIVERSITY OF TOLEDO MEDICAL CENTER

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## Unbelievable Bacteria: Evil, Alien or Smart, Part I

One of the ways bacteria enters the body is through an open wound. When the open wound goes clear down to a fracture bone, it is called an open fracture. When bacteria gain access to the deeper tissues through the open wound, the tissues become contaminated.

Pre-operative and prophylactic antibiotics are given to help decrease the infection rate with the hope of killing the bacteria in the contaminated region. In addition to pre-operative and prophylactic antibiotics, a special treatment is done when there is an open fracture to help to further prevent infection. This treatment consists of irrigating and washing the wound as well as debridement of the dead tissue. Culture of an open wound or post debridement of the wound is not very helpful in identifying the nature of future infection.

Once the tissue has been adequately cleaned, the fracture needs to be reduced and stabilized. The three different ways to stabilize a fracture are with a plate, a rod, or an external fixator. The open wound is either left open for a variable amount of time or it is closed later on. There are some bone graft substitutes that help in bone healing. Some of them are more expensive than others.

At the time of wound closure, a skin graft or flap may be needed. To promote healing of the fracture, a bone graft may be needed usually 4 to 6 weeks after the injury. Bone graft is obtained from the pelvis as it has a large reserve of bone to be utilized. The bone that is harvested is cut into pieces and then added to the fracture where needed.

Despite the best care, a certain percentage of open fracture injuries will become infected. When the tissues become infected by bacteria, white blood cells are attracted to the infected site where the bacteria are multiplying and causing inflammation. Bacteria multiply by replicating their DNA and then dividing into two identical bacterial cells. Due to this doubling of bacterial cells, the population of bacterial cells grows rapidly.

Once at the site of infection, the white blood cells begin to ingest the bacteria. These bacteria, however, may survive and multiply within the white blood cell causing the white blood cells to burst. This



*When bacteria gain access to the deep tissues through the open wound, the tissues become contaminated*

releases the bacteria back into the tissues. Other types of bacteria can also produce a thick capsule which prevents them from being engulfed. Bacteria may also produce toxins used to destroy cells that try to attack them. Bacteria can also hide in dead bone or bone cells. This causes the antibiotic or white blood cells to be unable to reach the bacteria since the dead bone has no blood supply.

In addition to the bacteria hiding in the bone, the bacteria grow rapidly. During this growth period, the bacteria are communicating with each other through a process called quorum sensing. This refers to the use of a chemical signal from one bacteria to another—it's like their chemical language. As the bacterial population grows, so does the chemical signal concentration. Once the concentration of the chemical signal reaches a certain threshold, the bacteria then begins their attack. The bacteria attacks the tissues causing it to break down and die which can lead to an abscess formation. The abscess must be drained and evacuated followed by antibiotic treatment.

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Antibiotics can kill bacteria in several different ways. One way is by disrupting the cell wall which ruptures the bacteria. Another way is by preventing DNA replication by blocking the unwinding of the DNA. A third way is by inhibiting the ribosomes from making proteins needed for the cellular structure and function. The last way is by blocking the enzymes which produce folate. Folate is needed for

DNA synthesis and without it, the cell will die. Specifically, sulfa inhibits the enzyme that makes folate. Antibiotics can't cure an infection. Cleaning, washing and debriding the wound is critical.

When hardware is used to stabilize the fracture, the story can become much more complex. Please stay tuned for part II for more information.

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## Patient Recovers After a Serious Motor Vehicle Accident

On August 11, 2010 Robert Stern returned to the Orthopaedic Center for follow-up. He wasn't celebrating his birthday or his wedding anniversary. Instead, it was just days after his 5 year anniversary since being involved in a motor vehicle accident in 2005.

"I'm lucky to be alive," Stern said with wide-eyed grin.

Stern, who was 75 years of age at the time of the accident, suffered several injuries. He was transferred to the University of Toledo Medical Center after the motor vehicle accident with the following injuries: an open distal femur fracture; a non-displaced femoral neck fracture; an open humerus and olecranon fracture; and a scapular fracture.

With quality care, however, Mr. Stern was quickly on the road to recovery. The Orthopaedic team quickly went to work to restore Stern's function and get him back to enjoying his life. Five years later, Stern returns to the Orthopaedic doing quite well. He was in good spirits and quick to compliment the quality care he received at the University of Toledo.

"The entire team, especially the Orthopaedic Center, did an excellent job for me," Stern said. "I'm thankful I was brought to the



Robert Stern

University of Toledo. Everyone was helpful and caring and willing to do whatever it took to get me back in good health."

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## Coccydynia

Coccydynia refers to pain and tenderness originating from the coccyx. The coccyx, better known as the tailbone, is the most distal aspect of the vertebral column. It consists of 3-5 vertebral units. With the exception of the first segment, the vertebral units are fused allowing for limited movement.

While the cause of coccydynia is usually idiopathic, some are identifiable. Coccydynia can sometimes be the result of the following:

- Trauma, such as falls
- Abnormal or excessive movement of the tailbone
- Infection or tumor
- Fractures
- Giving birth

Patients with coccydynia will commonly present with complaints of

pain when increased pressure is applied to the tailbone. Other symptoms include: deep aches in the tailbone region; pain during bowel movements; and pain when changing from a sitting to a standing position.

To diagnose coccydynia, doctors will perform a thorough history and physical examination. During the examination, the doctor will inspect and palpate the area to identify pain/tenderness and any abnormal masses or abscesses. In addition, x-rays, CT scans or MRI's may be taken to confirm the diagnosis and to rule out other possible pathology.

Coccydynia can usually be treated conservatively. Physicians may utilize the following: anti-inflammatory medications; therapeutic seating; physical therapy; heat; massage; ultrasound; and manipulation. Cortisone injections may also be used to reduce pain and inflammation. In rare cases which fail to respond to conservative treatment, surgery to remove the coccyx (coccygectomy) is needed.

# Body Positions Affecting the Spine

Postural changes have varying effects on lumbar disc pressure at different positions.

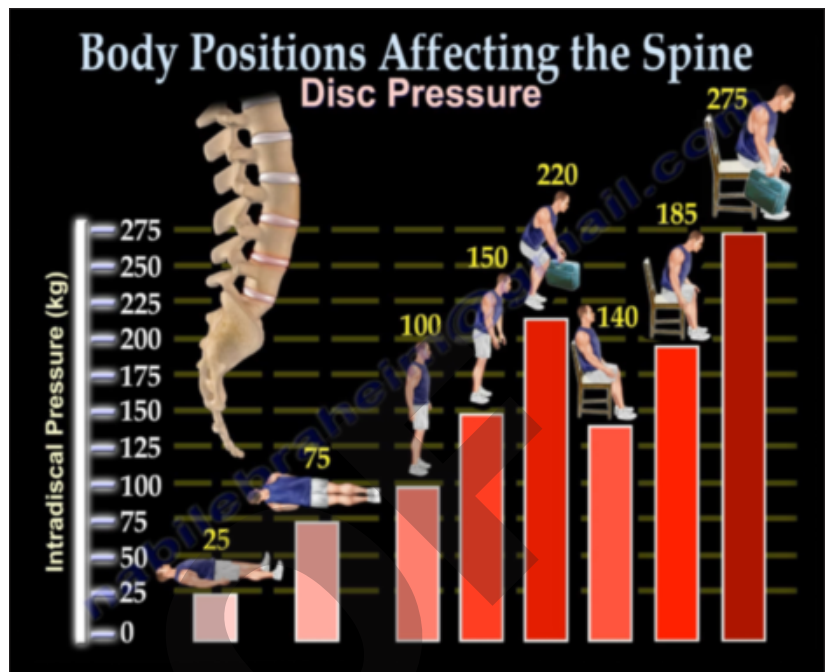
Disc pressure and stress on the lumbar spine is at its lowest when you lying flat on your back in the supine position (25 kg). These stresses slightly increase as you move from the supine position to lying on your side (75 kg). One hundred kilograms of pressure is measured on the discs of the lumbar spine when you are standing in the upright position. When leaning forward from the standing position, the pressure increases to 150 kilograms. Holding a load and leaning forward in the standing position causes this pressure to increase to 220 kilograms. A non-load-bearing position such as sitting upright will place 140 kilograms of pressure on the lumbar disc. Leaning forward from this sitting position raises the pressure to 185 kilograms of pressure. Finally, the highest pressure is measured while sitting with 20 degrees of forward leaning while holding a load. The idea is to hold the weight closest to your body to reduce the pressure being placed on the discs.

Intradiscal pressures associated with the seated position in postural changes have proven to be greater than the same positions performed while standing. Factors which may contribute to pain or degeneration of the lumbar spine include:

- Lack of fitness
- Heavy lifting
- Operating motor vehicles such as driving a semi-truck
- Prolonged sitting
- Operating vibrating tools
- History of cigarette smoking

Job dissatisfaction or lack of interest in your profession are psychological factors which also may play a role in the development of lower back problems.

Physical examination techniques are essential in helping to determine the cause of low back pain. The straight leg raise test or



tension sign indicates disk herniation. In classic sciatica, a herniated disc is indicated to be on the opposite side of the leg which is raised. Range-of-motion testing involving flexion of the spine will also produce pain in patients who have disc-related disorders. Patients with spinal stenosis or spondylolisthesis will also demonstrate pain during extension of the lower back. The foraminal area of the spine decreases by 20 percent during extension. This area increases by 12 percent with flexion of the spine. Because of the pain experienced with extension of the spine, patients suffering from spinal stenosis get relief by leaning forward. The Faber test is helpful in determining patients with sacroiliac joint problems. The purpose of this test is to stretch the sacroiliac joint in order to reproduce pain. Diagnostic injection of the sacroiliac joint is the only proven method to confirm diagnosis of sacroiliac joint dysfunction.

References: Nachemson AL. Disc Pressure Measurements. Spine (Phila Pa 1976). 1981 Jan-Feb;6(1):93-7.

## Sinus Tarsi Syndrome

The sinus tarsi is a small osseous (bony) canal which runs into the ankle under the talus bone. Sinus tarsi syndrome refers to pain and tenderness localized at the opening of the outside of the foot between the ankle and the heel bone. The sinus tarsi's synovial fluid and tissue becomes inflamed when injured or aggravated, causing pain and tenderness.

The talocalcaneal joint, also known as the subtalar joint, joins the talus and calcaneus. This joint is held together by the medial, lateral, posterior and interosseous subtalar ligaments. These ligaments run through the sinus tarsi which is the canal between the articulations of the talus and the calcaneus.

Sinus tarsi syndrome is usually the result of poor foot biomechanics that causes stress within the joint due to excessive motion. Hyperpronation or overpronation is the most commonly identified biomechanical problem for patients with sinus tarsi tunnel syndrome. Pronation refers to the slight inward rolling motion of the foot during walking and running. When the foot rolls (pronates) more than normal, the arch flattens and causes stress and pressure on the soft tissues of the foot. Other causes for sinus tarsi syndrome include gout and osteoarthritis.

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*Sinus Tarsi Syndrome continued*

Patients with sinus tarsi syndrome will likely present with the following symptoms:

- Pain that worsens with exercise on uneven surfaces
- Tenderness along the outside of the ankle
- Pain in front of the lateral malleolus
- Passive inversion of the subtalar joint

To diagnose sinus tarsi syndrome, physicians will utilize a combination of physical examination and imaging. During physical examination, physicians will look for tenderness and pain over the outside of the ankle while MRI imaging may be helpful in identifying excessive fluid in the sinus tarsi. Injections may also be helpful in confirming the diagnosis of sinus tarsi syndrome.

To effectively manage sinus tarsi syndrome, it is essential to correct existing biomechanical problems with the foot. This can be identified with a thorough biomechanical examination and gait analysis. Orthotics are often used to correct the issue of over-pronation/hyperpronation. In addition, physicians may suggest rest, ice, anti-inflammatory medications and mobilization of the subtalar joint. If pain persists, physicians may suggest trigger point injections.

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