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The essence of medical practice

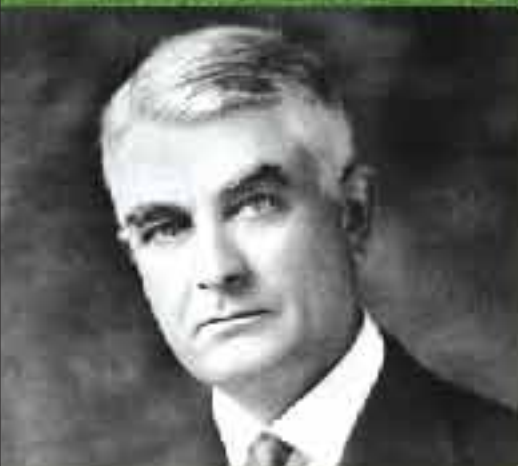


ADVANCING
POSSIBILITIES

INSPIRATIONAL MESSAGE

'The aim of medicine is to prevent disease and prolong life, the ideal of medicine is to eliminate the need of physician.'

*William James Mayo
(1861 - 1939)*



William James Mayo was a physician and surgeon in the United States and one of the seven founders of the Mayo Clinic. Mayo earned his medical degree from the University of Michigan in 1883, where he became a founder of Nu Sigma Nu Medical Fraternity. Afterwards he returned to Rochester to practice medicine along with his father and his brother Charles. He and his brother, Charles Horace Mayo, both joined their father's private medical practice in Rochester, Minnesota, USA, after graduating from medical school in the 1880s. In 1919, that practice became the not-for-profit Mayo Clinic.

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EDITORIAL

Dear Doctors,

We are much delighted to present you the third issue of our scholarly Info Medicus. The aim of this issue is to combine the various perspectives of clinical as well as basic research in the discipline of medicine. Its mission is to become the voice of the medicine community, addressing physicians and surgeons. Many people in their day to day life may experience low back pain, leg cramps, burning foot, etc. This is the reason we have envisioned and founded to represent sciatica as our topic for review article.

We believe that medical science is advancing sharply as one such example is the treatment of second degree burn with fish skin which is our topic for current health in this issue. Our second topic ensures malaria will be hopefully deducted from the list of deadly diseases as its vaccine is to be tested in the following year.

Pulse oximetry is one of the precious clinical instruments that the physicians have been using. We have brought pulse oximetry in our essential procedure and we hope it will provide the most hidden information of this device. We have also chosen a curious case in our case review. Other sections are presented as usual.

Your faith in us is growing with every quarterly issue, which is highly inspiring to us. We assure you that in our future issues we shall provide many interesting articles and news that will help in your clinical practices.

Thanks and best regards!



(Dr. S. M. Saidur Rahman)
Deputy General Manager
Medical Services Department



(Dr. Rumana Dowla)
Manager
Medical Information & Research



Sciatica

Sciatica is a commonly used term to indicate pain radiating from the lower back into different locations in the legs and feet; these may include pain generated from the inguinal to femoral regions as well

Introduction

Sciatica is also commonly referred to as radiating leg pain, along with back pain, and a disability that can be commonly converted into a pain scale from (no pain) 0 to 100 (worst pain). Sciatica can be caused due to nerve impingement at the lumbarsacral nerves, and muscular entrapment to the piriformis muscle. In about 90% of cases, sciatica is caused by a herniated disc with nerve root compression. Lumbar disc herniation defined as protrusions of disc material that go outside the confines of the annular lining, is a common condition that affects the spine in young and middle aged adults and is one of the leading causes of lower back pain and sciatica. The first approach to treatment in sciatic patients is the use of conservative treatments, which commonly includes the use of dermal analgesics (pain numbing), reduction in activity, rest, physical therapy, chiropractic care,

pharmacotherapy, medications, and alternative medicines, along with saline injections, or steroidal epidural injections at its most severe. If the conservative approach is of no relief, then more invasive procedures such as total disc replacement, or percutaneous laser disc decompression (PLDD) can be called for. The most commonly used invasive treatment is epidural injections and it is thus far the most effective for short term treatment for sciatica. However, in this review we have discussed about the causes, clinical features and management of sciatica.

Pathophysiology

The intervertebral disc was implicated in the pathophysiology of sciatica and with the assumption that the protruding disc exerted pressure on sciatic nerve roots, the treatment was surgical removal of the disc. Any subsequent improvement in symptoms was attributed to relief of pressure on the

nerve roots. Disc pathology and stenosis with apparent neural compromise have been shown to be a relatively common finding in asymptomatic patients. Symptomatic patients with disc herniation may experience marked improvement in symptoms without any alteration of the original pathology, whereas the removal of herniated disc material or other causes of nerve root compression does not always relieve pain. A positive correlation was noted between contact pressure and pre-operative neurological impairment, suggesting that pressure leads to loss of function rather than pain, whereas chymopapain, a substance used for chemonucleolysis of herniated lumbar discs, may cause a rapid relief of leg pain that precedes any change in the size of the disc herniation or degree of nerve root impingement. These observations suggest that processes other than pressure on nerve roots are involved in the development of sciatica neuralgia. The evidence suggests that a complex interplay of immunological, and pressure related processes may be involved.

Immunological: There is some evidence to suggest that the immune system also may play a part in the reaction between the nerve root and the exposed nucleus pulposus. Glycosphingolipids (GSLs) are particularly abundant in cell types of the central and peripheral nervous system. Antibodies to GSLs were measured in patients with acute and chronic sciatica and those who had lumbar discectomy for disc herniation. Raised antibody levels to GSLs were an overview of the pathogenesis of discogenic sciatica. Finally, an immune reaction to nervous tissue may be involved in the pathogenesis of both acute and chronic sciatica.

Mechanical compression: There is also some evidence to suggest that nerve root compression may also be involved.

Administration of a nitroprusside infusion, a source of NO, leads to increase ectopic firing only in those with cauda equina compression. An observational study, with magnetic resonance imaging (MRI) in consecutive patients with leg pain, noted that 9.6% had no disc disease, 3.3% bulging, 11.4% protrusion, 68.5% extrusion, and 7.1% disc sequestration, respectively. Histological examination of nerve roots revealed edemas in both nucleus pulposus in exposed and displaced nerve roots, being slightly more severe in the displaced group. From the above evidence, it could be proposed that radicular pain in sciatic nerve roots arises from a complex interaction of immune, and pressure related elements.

Etiology

Lumbar bulging or herniated disc: A bulging disc is also known as a contained disc disorder. This means the gel like center (nucleus pulposus) remains enclosed within the tire like outer wall (annulus fibrosus) of the disc. Sciatic pain can be caused by herniated discs in the lumbar and sacral region and can range in level, depending on the severity of the herniation. A herniated disc occurs when the nucleus breaks through the annulus. It is called a non-contained disc disorder. Whether a disc bulges or herniated, disc material can press against an adjacent nerve root and compress delicate nerve tissue and cause sciatica. The consequences of a herniated disc are worse. Not only does the herniated nucleus cause direct compression of the nerve root against the interior of the bony spinal canal, but the disc material itself also contains an acidic, chemical irritant (hyaluronic acid) that causes nerve inflammation. The severity of pain and of the herniation will dictate the proper course of treatment methods that are best for the patient. Yet, the disc herniation in sciatica does not always lead the patient to suffer

from sciatic pain, however most often a disc herniation causes some level of pain. In both cases, nerve compression and irritation cause inflammation and pain, often leading to extremity numbness, tingling and muscle weakness.

Lumbar spinal stenosis spinal: Stenosis is a nerve compression disorder most often affecting mature people. Leg pain similar to sciatica may occur as a result of lumbar spinal stenosis. The pain is usually positional, often brought on by activities such as standing or walking and relieved by sitting down. Spinal nerve roots branch outward from the spinal cord through passageways called neural foramina comprised of bone and ligaments. Between each set of vertebral bodies, located on the left and right sides, is a foramen. Nerve roots pass through these openings and extend outward beyond the spinal column to innervate other parts of the body. When these passageways become narrow or clogged causing nerve compression, the term foraminal stenosis is used.

Piriformis syndrome and back pocket sciatica: The piriformis syndrome has been attributed to compression of the sciatic nerve underlying the piriformis muscle, which stabilizes and serves as an external rotator of the hip. Although the nature and frequency of the syndrome are uncertain, the most consistent features, derived from a systematic review, are focal mid buttock pain, tenderness over the sciatic notch, aggravation of pain after sitting and provocation with maneuvers that increase piriformis muscle tension such as external rotation of the hip. Pain with the straight leg-raising maneuver was reported in a meta-analysis to occur in approximately half of cases. It is presumed that an injured piriformis muscle, sometimes caused by running, stretching or lunging, compresses the sciatic nerve, but the pathophysiology

is unclear. Electro-diagnostic and imaging tests are usually normal. Wallets, cell phones in back pockets and prolonged sitting on hard surfaces, including car seats can also produce sciatica.

Spondylolisthesis: Spondylolisthesis is a disorder that most often affects the lumbar spine. It is characterized by one vertebra slipping forward over an adjacent vertebra. When a vertebra slips and is displaced, spinal nerve root compression occurs and often causes sciatic leg pain. It is categorized as developmental (found at birth, develops during childhood) or acquired from spinal degeneration, trauma or physical stress i.e. weight lifting.

Zoster sine herpette: For the first few days before the eruption of shingles in a lumbar or upper sacral dermatome, herpes zoster reactivation closely simulates sciatica caused by disk rupture. Diagnosis is difficult in the intervening days and especially in the few instances in which the rash never develops.

Traumatic injury of the sciatic nerve: Traumatic injury of the sciatic nerve occurs with fractures of the pelvis or after proximal hamstring injury and with extreme stretching of the nerve. Muscle hematomas or tendinous injuries may cause severe sciatica. Posterior hip dislocation or femoral fracture impinge on the nerve; sciatica may also occur during relocation of the hip joint. Injection site damage in the buttocks is a self-evident but infrequent cause.

Spinal tumors: Spinal tumors are abnormal growths that are either benign or cancerous (malignant). Fortunately, spinal tumors are rare. However, when a spinal tumor develops in the lumbar region, there is a risk for sciatica to develop as a result of nerve compression.

Obesity: Most people know that obesity contributes to the development of coronary heart disease, diabetes, high blood pressure and colon cancer. The obesity is a causative factor to back pain. Being overweight or obese can significantly contribute to symptoms associated with osteoporosis, osteoarthritis, rheumatoid arthritis, degenerative disc disease.

Gynecologic: Deposits of endometrial tissue on the proximal nerve can cause recurrent cyclic or catamenial sciatica, more often on the right side than on the left side. Large ovarian cysts and uterine enlargement associated with late pregnancy can compress the nerve between the fetal head and the pelvic brim. It is not unusual for a woman to have unilateral or bilateral sciatica post-partum, regardless of whether forceps were used during delivery; sciatica ostensibly occurs after a woman has spent a prolonged time in the lithotomy position.

There are some risk factors that contribute to sciatica. The following risk factors are given in Table 1.

Table 1: Risk factors of sciatica	
Personal factors	
Age	
Height	
Smoking	
Mental stress	
Occupational factors	
Strenuous physical activity	
Driving	

Clinical features

The most important symptom of sciatica is lumbosacral radicular leg pain that follows a dermatomal pattern radiating below the knee and into the foot and toes. The pain worsens with coughing; patients may report sensory symptoms, limited forward flexion of the lumbar spine, gait deformity

and unilateral spasm of the paraspinal muscles. Sciatic pain can vary widely, but some common symptoms are given below:

- ▶ Sharp pain in one part of the leg or hip and numbness in other parts
- ▶ The affected leg may feel weak and thin than unaffected leg
- ▶ There will be a mild tingling, dull ache or a burning sensation, the sensations may also be felt on the back of the calf or on the sole of the foot
- ▶ Redness and swelling on the back or spine
- ▶ Sciatica is usually occurs in only one leg at a time. The sensation is like an electric shock. Sciatica pain is often felt while sneezing, coughing, going to the toilet, or even while sitting, and may be accompanied by lower back pain

Diagnosis

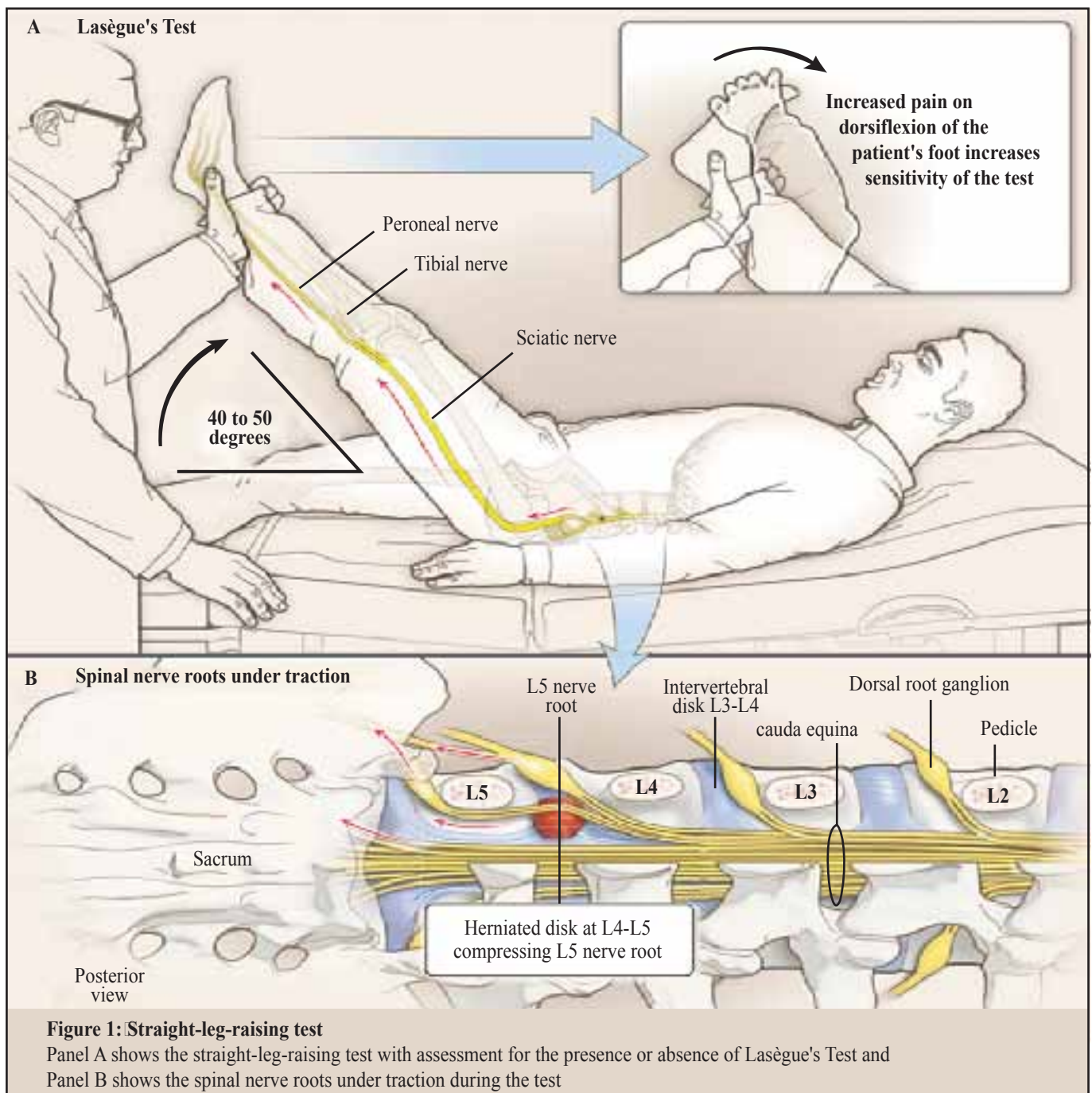
Sciatica is mainly evaluated by history taking, physical examination and clinical tests. Many clinical tests have been devised to determine whether sciatic pain is caused by disk compression of a spinal nerve root; most of the tests are variations of the straight-leg-raising test also known as Lasègue's test (Figure 1). In a patient in the supine position, raising the leg with the knee extended stretches the nerve root over the protruded disk and results in a response of muscle contraction. A positive test consists of reproduction or marked worsening of the patient's initial pain and firm resistance to further elevation of the leg. A diagnosis of disk compression is likely if pain radiates from the buttock to below the knee when the angle of the leg is between 30 and 70 degrees. Many persons without spinal abnormalities have hamstring and gluteal tightness with discomfort elicited by straight leg raising, but the pain is more diffuse than in sciatica

and the leg can be lifted higher if the maneuver is performed slowly. Increased pain on dorsiflexion of the foot or large toe increases sensitivity. The crossed straight-leg-raising test (Fajersztajn's test) involves raising the unaffected leg; in a positive test, sciatic pain is elicited in the opposite (affected) leg. This test is 90% specific for disk herniation on the contralateral side but is insensitive. There are some indicators which may help to diagnosis of sciatica and the indicators are given in Table 2.

Imaging: Imaging may be indicated only if there are indications that the sciatica may be caused by underlying disease (infections, malignancies) rather than disc herniation. Diagnostic imaging may also be indicated in patients with severe symptoms who fail to respond to conservative care for 6 to 8 weeks. In these cases, imaging used to identify if a herniated disc with nerve root compression is present and its location and extent.

Table 2: Indicators of sciatica

Unilateral leg pain greater than low back pain
Pain radiating to foot or toes
Numbness and paraesthesia in the same distribution
Straight leg raising test induces more leg pain



Magnetic resonance imaging: The nature and location of disk rupture and spinal lesions, such as osteoarthritic disease and spondylolisthesis, lateral recess stenosis, and synovial cysts of the facet joint, can be accurately seen on magnetic resonance imaging (MRI) without the administration of gadolinium. A high rate of minor abnormalities are seen on MRI in patients without back or radicular symptoms but that disk rupture is seen in less than 1% of asymptomatic patients.

Computed tomography: Computed tomography (CT) is performed less frequently but reveals most disk herniations and structural changes of the spine. CT and MRI each have a role in exploration of the pelvic fossa when sciatic compression is suspected in those regions.

Electromyography: Electromyography (EMG) aid in diagnosis by revealing a topographic distribution of muscular denervation corresponding to a nerve root. Denervation occurs longer in distal than in proximal muscles. The most specific findings are fibrillations and sharp waves in muscles corresponding to a single nerve root, the latter is the result of the preganglionic site of root compression, leaving the cell body and distal axon unaffected.

Treatment

Conservative treatment

Self-care measures can help relieve the symptoms of sciatica and also prevent recurrence. The conservative treatment are given in the Table 3.

Medications

Pain medications may vary considerably. Specific types and causes of pain may respond better to one kind of pain medication than to another kind. These all

Table 3: Conservative treatment of sciatica

By using alternate cold and hot packs, swelling can be reduced and discomfort can be relieved

Good posture must be practiced. A good posture is received when a person stands up straight with the ears aligned with the shoulders and the shoulders must be aligned with the hips with the knees slightly bent

Regular exercise should be done as it improves flexibility and helps prevent age related degenerative changes in the back

One should be very careful while lifting objects. Objects should always be lifted from a squatting position, using the hips and legs to do the heavy work and the back should never be bent over nor it should be straight

Sitting or standing for extended periods should be avoided. If anyone sit at work, take regular breaks to stand and walk around

One should sleep in a proper sleeping posture. The best method is to take pressure off the back by sleeping on one side or on the back with a pillow under the knees

Wearing high heels should be avoided. Shoes with heels that are more than 1½ inches high shift the weight forward, throwing the body out of alignment

Abdominal crunches should be done regularly. These exercises strengthen the abdominal muscles that help to support the lower back.

By laying with the face in down position and clasping the hands behind the lower back, the head and chest should be raised slightly against gravity while looking at the floor

By sitting on a chair, body should be stretched and slightly bent down towards the floor. This exercise should be repeated 6 to 8 times. It should be stopped when there is slightly discomfort

One should lie on his back and should gently pull the knees to provide a comfortable stretch

One should regularly walk and swim as these two exercise help to strengthen the lower back

may suppress the sciatica pain temporarily, not permanently. Medications used to treat pain include:

Analgesics: Analgesics such as acetaminophen and tramadol are used, they can relieve pain but they don't have the anti-inflammatory effects of NSAID.

Nonsteroidal anti-inflammatory drug (NSAID): NSAID such as aspirin, ibuprofen, naproxen, and celecoxib are examples of nonsteroidal anti-inflammatory drugs that are used to reduce inflammation and relieve pain. Long term use of analgesics and NSAID may cause stomach ulcers as well as kidney and liver problems.

Muscle relaxants: Muscle relaxants such as baclofen can be used to treat pain associated with muscle spasms and spasticity.

Anticonvulsants: Anticonvulsants such as phenytoin and carbamazepine, gabapentin can be used to relieve nerve pain as in trigeminal neuralgia.

Steroids: Steroids can be used to reduce the swelling and inflammation of the nerves. They are taken orally in a tapering dose over a five day period. They have the advantage of providing pain relief within a 24 hour period. Steroid injections may be prescribed into the area of the pain, if the pain is severe.

Epidural steroid injections: This procedure is usually performed under fluoroscopy, and it involves an injection of steroids with an analgesic numbing agent into the epidural space of the spine to reduce the swelling and inflammation of the nerves. About 50% of patients will notice relief after an epidural injection, although the results tend to be temporary. This procedure is usually done in a series of three, at 2 week intervals, to obtain the best results in the shortest time. If the injections are helpful, the series can be done up to three times a year.

Facet injections: Facet injections are used for patients with lowback pain stemming from inflammation or irritation of the facet joint. They may be performed using a fluoroscope (X-ray), which directs a needle through the skin and muscles to the path of the sensory nerves located in the facet joints. At that very same point, a mixture of numbing medicine and cortisone is injected into the facet joint.

Narcotics (opioids): Narcotics are very powerful pain relievers that deaden a person's perception of pain. They are used

for a short period about 2 to 4 weeks after an acute injury or surgery. Common narcotics include codeine, meperidine, propoxyphene, hydrocodone, and oxycodone, sumatriptan and naratriptan, are used to relieve migraine headache.

Surgical treatment

Sciatica resolves without treatment in one third of patients within 2 weeks and in three quarters of patients within 3 months after onset. Nevertheless, most trials comparing surgical treatment and conservative treatment of sciatica due to lumbar disk disease favor surgery, because it results in earlier relief of pain. Patients who had sciatica for 6 to 12 weeks and were assigned to lumbar disk surgery had faster and more pronounced pain relief than those assigned to conservative treatment. Surgery has been recommended in cases of large disk ruptures into the spinal canal that compress the cauda equina and cause failure of the bladder sphincter or the bowel sphincter.

Treatment of sciatica by means of decompression of a lumbar nerve root is most likely to succeed if symptoms conform to the typical clinical pattern and imaging studies show disk rupture. Several open and percutaneous surgical approaches have been devised. A unilateral hemilaminotomy (removing parts of adjacent lamina on the side that needs to be decompressed) is usually adequate. In the past, bilateral laminectomy, a more extensive procedure, was performed, but the unilateral procedure is favored because it preserves tension and alignment between adjacent spinal segments. Microdisectomy and various minimal invasive and percutaneous techniques involving, a series of tubular retractors or an endoscope, are also used to treat disk rupture.

Prognosis

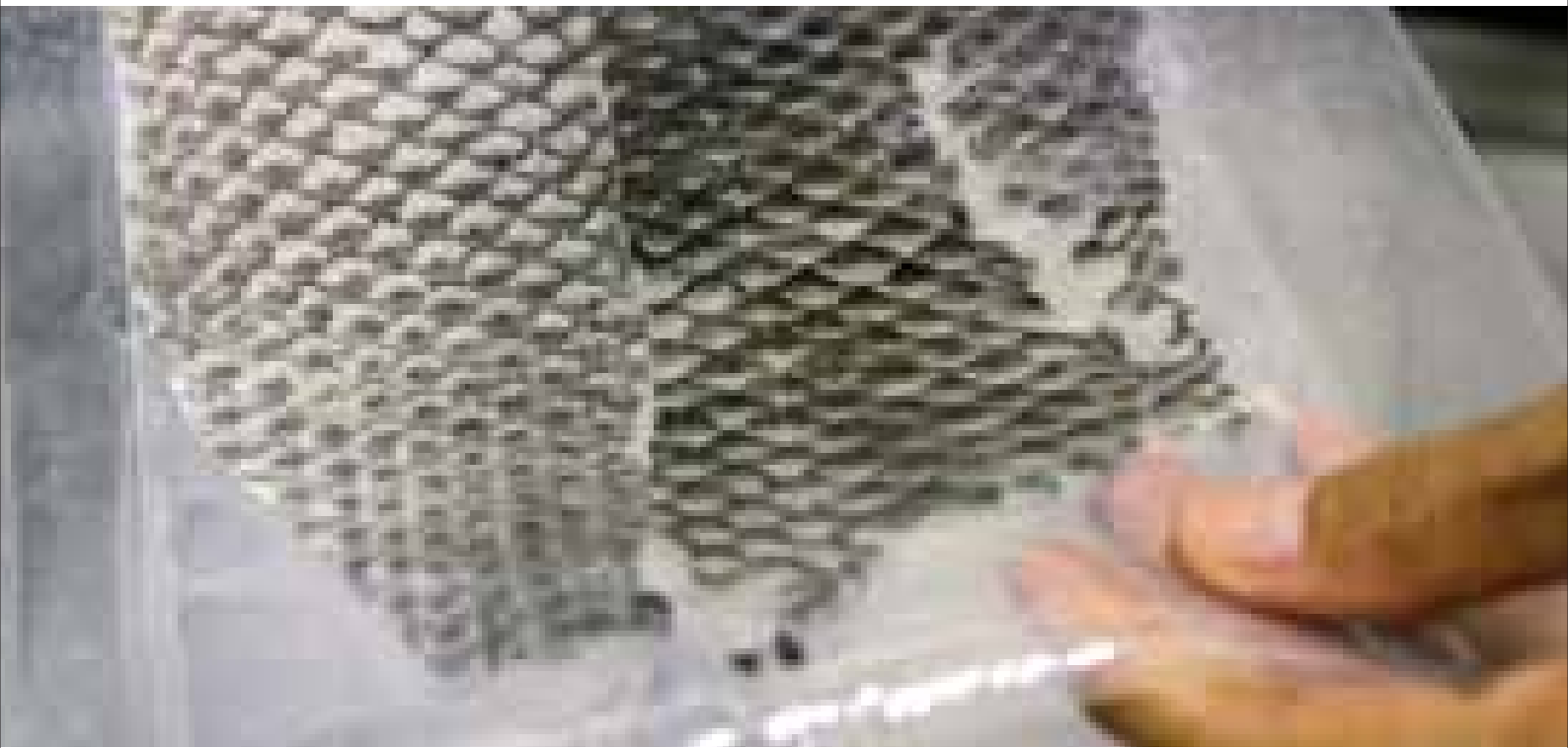
In general the clinical course of acute sciatica is favourable and most pain and related disability resolves within two weeks. For example, in a randomised trial that compared non-steroidal anti-inflammatory drugs with placebo for acute sciatica in primary care 60% of the patients recovered within 3 months and 70% within 12 months. About 50% of patients with acute sciatica included in placebo groups in randomized trials of non-surgical interventions reported improvement within 10 days and about 75% reported improvement after four weeks. In most patients therefore the prognosis is good, but at the same time a substantial proportion (up to 30%) continues to have pain for one year or longer.

Summary

Despite the numerous guidelines and systematic reviews that have been published regarding the treatment of low back pain in patients with and in those without sciatica, the outcomes and the cost of care have remained unchanged for more than a decade. A discursive analysis by the National Institute of Health Research, in the United Kingdom, about the effectiveness of various strategies to manage sciatica showed support for almost all current treatments, including disk surgery, epidural glucocorticoids, chemo-nucleolysis, and alternative therapies. Surgery benefitted all aspects of global effect, pain relief, and a composite of condition specific outcomes in the short, medium, and long term.

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Fish skin is used for treatment of second degree burn

First time in medical history, scientists have used the skin of a fish as a plaster to treat wounds, specially second degree burn wound

A 36 year old woman who had suffered severe burns has been given fish skin to reduce her injuries in pioneering new treatment. Maria Ines Candido da Silva, who worked as a waitress at a restaurant in north east Brazil, was the first patients to be treated with the Tilapia fish skin treatment. An explosion from a gas canister at the restaurant she was working at caused severe burns to her arms, neck and some of her face. Doctors offered her an alternative treatment, to dress her wounds with the skin of a common freshwater fish. The doctors used the skin from Tilapia fish, a disease resistant species found in Brazilian rivers. Before the fish strips are used, researchers put the skin through a rigorous process that removes scales, muscle tissue, toxins and any possibility of transmitted diseases. It also gets rid of the fishy smell.

The result is something similar to human skin, which remains flexible and easy to mould around a wound. It is then placed

over the person's damaged skin for up to 11 days before being removed. Then doctors remove the scaly skin using petroleum jelly to lift, slide and ease the dressing away from the healed area. It is stretched and laminated then stored in refrigerated banks, in strips of 10 cm by 20 cm for up to two years. According to Dr. Edmar Maciel, one of the plastic surgeons who developed the treatment, Tilapia skin contains 'optimum levels of collagen type one' and high degrees of humidity, so it takes a long time to dry out.

It seems that by carefully harvesting, processing and freezing, skin from wild and farmed tilapia, are able to use it as a dressing to cover burned skin, Gomez reports. Scientists at the Federal University of Ceara in northern Brazil have found that tilapia skin has moisture, collagen and disease resistance at levels comparable to human skin, and can aid in healing.

Reference: www.businessinsider.com



First malaria vaccine to be widely tested in Africa next year

The World Health Organization announced that Monday to be the day to try the first malaria vaccine in the field next year. The organization made the announcement on the eve of World Malaria Day

According to the WHO, there has been enormous progress in fighting malaria. There have been fewer deaths in large part because of better mosquito control and disease awareness, as well as sustained effort to get the right medicine to the right populations. Africa is the continent that sees the highest number of malaria cases. The new vaccine will be tested in Kenya, Ghana and Malawi starting in 2018.

Dr. Photini Sinnis, deputy director at the Johns Hopkins Malaria Research Institute and professor at Johns Hopkins Bloomberg School of Public Health said that this would be a great news. She stated that it has shown an enormous success and this is the vaccine that has the capability to make a real difference. The vaccine, RTS, S, also known as Mosquirix, was created by scientists in 1987. It was developed in a public private partnership with the PATH Malaria Vaccine Initiative and with support from the Bill and Melinda Gates

Foundation along with local health organizations from seven African countries. The vaccine will protect children from the deadliest form of malaria, known as *Plasmodium falciparum*. According to the WHO, other preventative malaria treatment is available for infants, but it has a slow uptake and it is being implemented only in Sierra Leone. If the vaccine works, it would become a part of the regular vaccine schedule for children in areas with high potential for malaria. In this case, it will be tested in children between the ages of 5 and 17 months.

Dr. Matshidiso Moeti, WHO regional director for Africa, said that the prospect of malaria vaccine is great news and the information gathered in the pilot program will help to make decisions on the wider use of this vaccine. Such a vaccine would have the potential to save tens of thousands of lives.

Reference: www.cnn.com



Pulse oximetry

Pulse oximetry is a technology used to measure the oxygen level in blood and heart rate as well as to detect changes in the blood oxygen level

Overview

Pulse oximetry has become the standard of care in operating rooms, intensive care units (ICUs), and hospital wards. Before pulse oximetry was available, physicians relied on invasive procedures, such as arterial puncture for blood gas analysis, to identify the presence of hypoxemia.

Definition

Hemoglobin can be functional or non-functional in terms of oxygen binding and transport. Functional hemoglobin binds and transports oxygen and is present as oxyhemoglobin, which is hemoglobin that contains bound oxygen, and deoxyhemoglobin, which is reduced hemoglobin, without bound oxygen. Nonfunctional hemoglobin is unable to bind or transport oxygen and is present as carboxyhemoglobin and methemoglobin. Carboxyhemoglobin is hemoglobin bound to

carbon monoxide. Methemoglobin is hemoglobin that contains ferric iron. The partial pressure of oxygen dissolved in arterial blood is termed PaO₂. The percent saturation of oxygen bound to hemoglobin in arterial blood is termed SpO₂.

Indication

Pulse oximetry is indicated in all clinical settings in which hypoxemia may occur, such as operating rooms, ICUs, post anesthesia care units, emergency departments and ambulances, endoscopy suites, sleep laboratories, cardiac catheterization laboratories, delivery suites, and wards. Pulse oximetry can also be used to screen for cardiopulmonary disease. It is generally safe to use in monitoring all patients.

Principles of operation

Pulse oximeters consist of a peripheral probe and a microprocessor unit.

Traditionally, the peripheral probe contains a photodetector and two light emitting diodes. The light emitted by the diodes is absorbed by tissues, and the amount of absorption is determined by the photodetector. It calculates the percentage of oxyhemoglobin and displays the hemoglobin oxygen saturation in arterial blood. Pulse oximeters function on the principle that oxygenated hemoglobin and deoxygenated hemoglobin absorb red and infrared light differently. One light emitting diode emits light in the red spectrum, at a wavelength of 660 nm, at which the light absorption of deoxyhemoglobin is greater than that of oxyhemoglobin. The other diode emits light in the infrared spectrum, at a wavelength of 940 nm, at which oxyhemoglobin absorbs more light than deoxyhemoglobin. The microprocessor analyzes the light absorption of the tissues at each wavelength to determine the concentrations of oxyhemoglobin and deoxyhemoglobin, respectively. The probe is positioned so that the photodetector and light emitting diodes face each other. During pulsatile flow, the light absorption of arterial blood, background tissues, and venous blood is detected. During nonpulsatile flow, only the light absorption of background tissues and venous blood is detected. The micro processing unit compares the light absorption during both pulsatile and nonpulsatile flow to isolate the light absorption of arterial blood and thus determine the SpO₂.

Data interpretation

Pulse oximetry provides both qualitative and quantitative data. The qualitative data are obtained through the sounds emitted by the pulse oximeter; these sounds correlate with the level of oxygen saturation. The quantitative data are obtained through the display of a pulsatile wave form that corresponds to the flow of arterial blood,

and the display of numbers indicates the SpO₂ and the heart rate.

Proper use of pulse oximetry

The ideal site for placement of the pulse oximeter probe is one that is well perfused, relatively immobile, comfortable for the patient, and easily accessible. If the probe is not the right size, the light emitting diodes may not line up correctly with the photodetector and may produce inaccurate data.

Common problems and limitations

One common problem is the occurrence of movement artifacts if there is movement at the probe placement site. This may interfere with proper function, and most often occurs if a patient is shivering or seizures. Electromagnetic radiation, such as that emitted by magnetic resonance imaging (MRI), may also interfere with pulse oximetry. If the probe is poorly placed or is the wrong size, light from only one light emitting diode may pass through tissues or the light may not reach the detectors. The presence of intravascular dyes, such as methylene blue or indigo carmine, may alter the red and infrared light absorption properties of tissues, which can also lead to an inaccurate reading. Methemoglobin absorbs more light than either deoxyhemoglobin or oxidized hemoglobin at 940 nm, but at 660 nm, the light absorption of methemoglobin is similar to that of deoxyhemoglobin. In this instance, the pulse oximeter cannot differentiate between methemoglobin and deoxyhemoglobin and may incorrectly perceive an elevated concentration of deoxyhemoglobin. It is important to remember that pulse oximeters function normally in anemic patients, who have reduced numbers of red cells. In an

extremely anemic patient, the oxygen saturation may be normal, but there may be insufficient hemoglobin to carry an adequate amount of oxygen to the tissues. A normal SpO₂ may be falsely reassuring in patients receiving supplemental oxygen because a drop in SpO₂ may occur only after the patient is severely hypercarbic. New generation pulse oximeters are manufactured with improved algorithms that minimize motion related erroneous data. In addition, because they use multiple wavelengths, these new pulse oximeters are capable of measuring the concentration of hemoglobin, carboxyhemoglobin, and methemoglobin.

Complications

Although the pulse oximeter is generally a safe device, its use still carries some risk of adverse events. Burning or blistering at the placement site may occur if the light emitting diode becomes overheated. Ischemic pressure necrosis may result if the probe is placed too tightly on the patient. Prolonged placement of a pulse oximeter probe, which can occur in patients in the ICU, may lead to mechanical injury, such as finger stiffness, making it difficult for the patient to flex the finger after the probe has been removed.

Summary

When used correctly, pulse oximetry is a potentially lifesaving tool. Health care providers need to be aware of the indications, benefits, and disadvantages of pulse oximetry. More important, clinicians must be able to interpret the information pulse oximetry provides. With proper training and instruction, clinicians will find pulse oximetry an irreplaceable monitoring tool.

Reference: NEJM, April 21, 2011; 364:16



Purple man syndrome: purpura fulminans secondary to meningococemia

Purpura fulminans is a thrombotic disorder which manifests as bruising and purplish discoloration of the skin which termed as purple man syndrome

Introduction

Invasive meningococcal disease is a serious life threatening infection. Skin rash is a very common clinical presentation in meningococcal infection. The cause of the skin rash ranges from mild allergic reaction to a serious disease manifestation. A patient with invasive meningococcal serogroup B infection with diffuse cutaneous purplish rash and ecchymoses, suggestive of purpura fulminans has been presented. Purpura fulminans is a telltale cutaneous manifestation of disseminated meningococemia, and it is, unfortunately, an ominous late sign of infection.

Case report

A 58 year old male presented to the local emergency department secondary to lethargy and confusion. The patient had been battling an upper respiratory tract infection with a productive cough with tan colored sputum for 2 weeks. The patient

had also been having fevers every three to four days along with myalgia and diarrhea. His past medical history was significant for diabetes mellitus and hypertension.

Upon the presentation to the local hospital, the patient was confused and combatted. His vitals showed temperature of 39.6° C (103° F), pulse rate of 128/minute, blood pressure of 114/58 mmHg, and respiratory rate of 36/minute, oxygen saturation was 92% on 4L supplemental oxygen. The patient was subsequently sedated and intubated. There was no skin rash noted on the admission. The initial laboratory studies revealed a white blood cell count (WBC) of $0.8 \times 10^3/\text{mm}^3$. Creatinine was 1.4 mg/dL, hemoglobin 13.1 g/dL, and platelets $80,000/\text{mm}^3$. Blood cultures were drawn and lumbar puncture was performed. Intravenous vancomycin and ceftriaxone were administered. Cerebrospinal fluid (CSF) studies demonstrated clear fluid, glucose 82 mg/dL, protein

39 g/dL, WBC 3/mm³ with 100% lymphocyte, The patient was then transferred to hospital for further management.

On arrival to hospital, the purplish purpuric rash was noted and it quickly became coalesced, diffuse and progressively generalized to the face, upper extremities, trunk, and lower extremities, suggestive of purpura fulminans. The repeat laboratory investigations lactic acid 10.1 mmol/L, illustrated creatinine 3.72 mg/dL, bicarbonate 12 mmol/L, WBC 6.13 x 10³/mm³, platelets 26,000/mm³, D-Dimer >20 mcg FEU/mL, FDP >160 mcg/mL, fibrinogen 116 mg/dL, and an INR 3.1. Vasopressor support, intravenous hydrocortisone, and continuous veno-venous hemodialysis were initiated. Intravenous gentamicin and doxycycline were added with the concern of tularemia or rickettsial infections considering his social history.

Blood cultures drawn showed gram negative diplococci, suspicious of *Neisseria meningitidis*. Less than 24 hours of transfer, the patient succumbed to multiorgan failure and disseminated intravascular coagulation despite optimal medical management. The blood cultures were finally reported as *Neisseria meningitidis*, and the specimens were dispatched to the local country health department for further analysis. The isolate was identified as *Neisseria meningitidis* serogroup B. The appropriate post-exposure chemoprophylaxis was provided to the patient's close family members and medical personnel at risk.

Discussion

Neisseria meningitidis is a gram negative aerobic diplococcus. In 2011, the rate of invasive meningococcal disease was 0.3 per 100,000 populations in the world.

Neisseria meningitidis is transmitted via direct contact with respiratory secretions and colonizes in mucosal surfaces of the nasopharynx. The most virulence factor of *Neisseria meningitidis* is the presence of polysaccharide capsule that enables organisms to resist phagocytosis by the host immune system. The persons at risk of invasive meningococcal infection include nasopharyngeal carriage, functional or anatomical asplenia, microbiologists, military recruits, and college students living in residence halls. *Neisseria meningitidis* is classified into serogroups according to immunologic reactivity of the capsular polysaccharide. Among the 13 different types of polysaccharide capsules, six serogroups cause most cases of invasive meningococcal disease globally (A, B, C, W-135, X and Y). 39% of meningococcal infections are secondary to serogroup B, followed by serogroup Y (30%) and C (25%).

Four clinical syndromes are most commonly associated with the invasive meningococcal infection, namely meningitis, meningococemia without meningitis, meningitis with systemic meningococemia, and primary pneumonia. Serogroup B or C is usually responsible for meningococemia and meningitis while serogroup Y causes the primary meningococcal pneumonia. Patients with meningococemia typically present with acute onset of fever, generalized muscle ache, cold extremities, skin color changes and shock. Cutaneous rash could start with petechiae or purpura, and is present in 40 to 80% of cases of meningococemia, like in this case. These lesions could progress quickly and coalesce into diffuse widespread purplish non-blanching rash (purpura fulminans), secondary to thrombosis of blood vessels with subsequent vascular damage and rupture

from septic vasculitis and disseminated intravascular coagulation. Purpura fulminans is classically associated with fulminant meningococemia.

A high clinical index of suspicion is essential for the early diagnosis and therapy. The third generation cephalosporins (ceftriaxone or cefotaxime) are the preferred antibiotic therapy of meningococcal infection. Two outbreaks of meningococcal serogroup B meningitis have led to the fast track approval of 2 serogroup B vaccines (MenB), MenB-FHbp and MenB-4C, by the Food and Drug Administration in October 2014 and January 2015, respectively. In 2016 adult immunization schedule, MenB vaccine is recommended for use in persons who are at increased risk of serogroup B meningococcal disease. This patient had diabetes mellitus and did not have any of those risk factors.

Conclusion

A detailed cutaneous examination is essential in patients with suspected meningococcal infection since the initial manifestation of the skin rash is subtle. Generalized purpura fulminans is a late skin manifestation and when present, the patient is almost always not salvageable. The recent approval of MenB vaccine use have improved the morbidity and mortality of the persons at risk of meningococcal infection. In summary, widespread use of meningococcal vaccination, heightened clinical vigilance of the disease, early recognition of skin rash, and immediate administration of the effective antibiotic therapy would have an impact on the reduction of mortality and improvement of clinical outcome in patients with invasive meningococcal disease.

Reference: JSM. Clin. Case Rep., 4 (6):1118 (2016)



Autism spectrum disorder

Autism spectrum disorder or ASD is characterized by severe and pervasive impairments in several important areas of development such as reciprocal social interaction and communication as well as behavior and imagination

Autism spectrum disorder (ASD) is a group of developmental disorders which describes the lasting problems with social communication and social interaction. Even if the parents often notice that something is wrong during infancy, it is very difficult to diagnose autism before the age of eighteen months. This is because the behavioral symptoms used to establish the diagnosis have not clearly emerged developmentally until that age. The majority of children with autism also have a learning disability (mental retardation), although a few have average intelligence. Many also have epilepsy, visual and hearing impairment.

Etiology

The role of genetics in ASD is suggested by a recurrence rate of autism in siblings of affected children that is approximately 10 fold higher than in the general population. Autism susceptibility genes have been demonstrated by whole genome screens of

families with multiple children with an ASD by cytogenetic studies of affected children and by the evaluation of candidate genes involved in brain development. The role of prenatal or postnatal environmental exposures in altering the expression of autism genes remains unclear. In a small percentage of children, autism is a feature of an underlying medical condition. A boy with autism, intellectual disability, macrocephaly, and large pinnae should be tested for fragile X syndrome, which is known to account for approximately 1% of all cases of autism.

Clinical features

The earliest sign of autism in children are:

- ▶ The delayed attainment of social skill milestones
- ▶ Language impairment
- ▶ Restricted interests and repetitive behaviors

Delayed attainment of social skill milestones: Delayed attainment of social skill milestones is the earliest and most specific sign of autism. Social orienting, or orienting to name, is another easily evaluated social skill milestone that, when absent, should prompt consideration of autism.

Language impairment: Delayed or odd use of language is a common early sign of autism. Infants who do not babble (e.g., single syllables, monotone voice) by six months of age or speak jargon by nine months of age may be exhibiting early signs of autism. Autism should also be strongly considered in children 18 to 24 months of age with speech delay. Children with autism have a diminished intrinsic drive to communicate. Unlike children with simple expressive language delay or those with mixed receptive and expressive language disorders, children with autism do not use pointing, gesturing, or facial expressions to compensate for their lack of spoken language.

Restricted interests and repetitive behaviors: Compared with early social and language impairments, restricted interests and repetitive behaviors are more variable in young children. Repetitive behaviors represent a continuum and may be exhibited by typically developing children. However, stereotypic movements (e.g., hand flapping), repetitive use of objects, and difficulty with changes in routine are more common and intense in children with autism.

Diagnosis

It is very difficult to diagnose autism spectrum disorder. However, the diagnostic criteria of autism spectrum disorder is given in Table 1.

Table 1: Diagnostic criteria for autistic disorder

- A. A total of six (or more) items from (1), (2), and (3), with at least two from (1) and one each from (2) and (3):
 1. Qualitative impairment in social interaction, as manifested by at least two of the following:
 - a. Marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
 - b. Failure to develop peer relationships appropriate to developmental level
 - c. A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people
 - d. Lack of social or emotional reciprocity
 2. Qualitative impairments in communication as manifested by at least one of the following:
 - a. Delay in, or total lack of the development of spoken language
 - b. In individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
 - c. Stereotyped and repetitive use of language or idiosyncratic language
 - d. Lack of varied, spontaneous make believe play or social imitative play appropriate to developmental level
 3. Restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least one of the following:
 - a. Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
 - b. Apparently inflexible adherence to specific, nonfunctional routines or rituals
 - c. Stereotyped and repetitive motor mannerisms
 - d. Persistent pre-occupation with parts of objects
- B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age three years: (1) social interaction; (2) language as used in social communication; or (3) symbolic or imaginative play
- C. The disturbance is not better accounted for by Rett's disorder or childhood disintegrative disorder

Management

The goals of management are to increase independent functioning, improve community engagement, and provide family and caregiver support. A successful long term management plan requires coordinating the efforts of educators,

therapists, physicians, and mental health professionals. Longer child visits may allow assessment of the health and well being of the child and their family.

References:

1. □ *Am. Fam. Phy., February 15, 2010; Vol. 81, N. 4*
2. □ *National Institute of Mental Health, September, 2015*
3. □ *Autismforum: An introduction to autism; 2004*

Limbal dermoid

A 14 year old boy presented with a growth on his left eye that had been there since birth and led to mild visual disturbance, sensation of a foreign body, and cosmetic disfigurement. There was no family history of similar lesions. Examination revealed a solid, brownish yellow, ovoid mass with partly keratinized epithelium involving the inferotemporal limbus and one third of the cornea. No associated regional or systemic abnormalities were found. Visual acuity was 6/6 in the right eye and 6/18 (20/60) in the left eye. The findings on slit lamp examination, funduscopy, and ocular ultrasonography were within normal limits, and intraocular pressure was normal. Limbal or corneal dermoids are unusual congenital tumors consisting of ectodermal and mesodermal elements in various proportions. They frequently warrant treatment to correct



cosmetic or visual problems. Excision with superficial keratectomy was offered to this patient, but he declined treatment and has not returned for follow up.

Reference: NEJM, February 10, 2011; Vol. 364, N. 6, P. e9

Burton's line

A 18 year old non-smoking man presented to the emergency department with a one week history of diffuse, colicky abdominal pain. He had no change in his bowel or bladder function. He had worked in a battery recycling factory for the past year. Examination revealed diffuse abdominal tenderness, as well as a bluish line around the gums, known as Burton's line. Results of routine hematologic, liver function, and kidney function tests were normal. Ultrasonography of the abdomen was unrevealing. The blood lead level was elevated at 81 ng per deciliter (3.9 nmol per liter) (reference range, <10 ng per deciliter [0.5 nmol per liter]). The patient was admitted to the hospital and started on chelation therapy with penicillamine. He was discharged in 2 weeks, after the pain had subsided and the blood lead level had declined. The Burton's line had disappeared. In developing countries, occupational exposure is



the main cause of lead poisoning. Persons working at sites where batteries or plastics are manufactured, at printing or recycling factories, or in the paint or ceramics industries are at greatest risk. Preventing exposure is the most critical intervention.

Reference: NEJM, September 6, 2012; Vol. 367, N.10, P. 937

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