

Mycoplasma Is An Overlooked Lyme Co-Infection

Got A Question? (comments are moderated & won't immediately appear)

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Getting Lyme



Mycoplasma infections are commonly found in people with Lyme Disease. But most doctors don't know to test for them.

These are the smallest organisms that can live independently. Of the over 100 known species, more than a dozen are found in humans. Many of them cause disease. They don't have a cell wall or cell nucleus, usually act like parasites within or outside host cells, and can take on different shapes. This versatility allows them to hide from the immune system and affect it in many ways. Because of these features, they are hard to diagnose and treat.

Mycoplasma Pneumoniae

The most common specie typically causes respiratory infections like pneumonia, bronchitis, pharyngitis, and asthma. But it's a stealth pathogen that can also cause non-respiratory diseases affecting the nervous system, blood, joints, skin, heart, liver, and pancreas.

Estimates of *Mycoplasma pneumoniae* cases each year in the United States are typically as high as two million. The disease tends to be cyclical both within a given year and across a decade. Most cases appear in the late summer and early fall with sharp spikes every three to five years. The disease spreads quickly from person to person by tiny droplets expelled during a cough.

Other Mycoplasma Species

The other pathogenic species most typically found in humans are:

- *M. fermentans*
- *M. genitalium*
- *M. hominis*
- *M. pirum*
- *M. salivarium*
- *Ureaplasma urealyticum*

- *Ureaplasma parvum*

Symptoms

Mycoplasma pneumoniae likes to live on the surface cells (mucosa) of the respiratory tract and can cause inflammation of most structures there. Bronchitis is most common. But it can also cause pneumonia/pneumonitis, laryngitis, and myringitis (inflammation of the eardrum). It's usually the cause of "walking pneumonia." It can cause "atypical" pneumonia – flulike symptoms such as fever, nonproductive cough, generalized aches and pains, and nasal congestion. Typical pneumonia usually involves a productive cough and chest pain close to the site of the pneumonia.

The bacterium can also cause neurological problems such as inflammation of the brain (encephalitis), aseptic meningitis, confusion, acute psychosis secondary to encephalitis, double vision and decreased vision, and temporary paralysis, mainly in the face.

When the organism infects the skin, it creates non-specific rashes. It can also cause eye infection. Muscle and joint aches occur in about 14% of people with this infection and can last beyond the primary infection.

Most of the other Mycoplasmas listed above are curious in that they are both normal and pathogenic in the urinary tract. A healthy person may have these microorganisms in the bladder or urethra and only in certain cases do they cause disease. These species can also cause disease in the brain, joints, and female reproductive tissues.

Specific infections that these other species can cause are:

- Infectious arthritis/septic arthritis
- Blood and lung infection in newborns (neonatal bacteremia/pneumonia)
- Inflammation of the covering of the brain in newborns (neonatal meningitis)
- Disorders of the eye and ear
- Periodontal disease and gingivitis
- Crohn's Disease and Irritable Bowel Syndrome
- Inflammation of the uterus (endometritis or chorioamnionitis) in pregnant and non-pregnant women
- Pelvic inflammatory disease
- Kidney infection (pyelonephritis)
- Surgical wound infections
- Inflammation of the urethra, which carries urine from the bladder to outside the body (urethritis)

The symptoms of these species can vary widely. Each of them causes symptoms specific of the disease, not the Mycoplasma. In other words, doctors may look for Mycoplasmas to explain pyelonephritis or septic arthritis among other, typical pathogens. Since they can cause particularly severe disease in newborns, doctors do look for the presence of these microorganisms in pregnant mothers and infants.

Testing

Since these organisms can be present without causing disease, diagnosis is challenging. Often doctors make the diagnosis by eliminating other causes (for example, *Mycoplasma* is the only bug they can find in a sick person) or antibiotic treatment is broad enough to treat it along with other identified infectious microorganisms.

Testing for *Mycoplasmas* is problematic for several reasons:

1. Growing this organism in a Petri dish (bacterial culture) requires special conditions and takes weeks, making microbiology culture a poor diagnostic tool.
2. Blood tests such as an erythrocyte sedimentation rate (ESR), white blood cell count, and cold agglutinin titer are elevated when the disease is present. However, none of these tests are specific for the microorganism.
3. One useful test is the rapid diagnostic enzyme-linked immunosorbent assay, which uses a specific antibody to detect its presence in a throat swab. These tests, available in some doctor's offices, take about ten minutes and provide reliable results but are very expensive.
4. The PCR test (Polymerase Chain Reaction) is considered the most reliable blood test for *Mycoplasma*, but will not reveal the bacteria if it's living instead in other body fluids and tissues. PCR tests are usually species-specific, expensive, and performed only by specialty laboratories.

Treatment

Common antibiotics such as Doxycycline, Azithromycin, Clarithromycin, Ciprofloxacin, and Tetracycline are usually used to treat this infection, typically requiring two to three weeks treatment, although long-term therapy may be needed in cases of chronic illness (like Lyme disease). Unfortunately, reports have emerged, especially in Asia, showing that *Mycoplasma pneumoniae* may be developing resistance to macrolides such as Azithromycin and Clarithromycin.

Natural plant antibiotics like olive leaf extract, Neem, and uva ursi are also used. In addition, supplements are usually required to rebuild and support the immune system.

The same goes for the infections of the urinary tract or genitals, which are typically treated with a weeklong course of Tetracycline. Researchers have found, however, that half the cases of *Mycoplasma* urinary tract infection are caused by bugs resistant to Tetracycline. Clindamycin may be used in instances of Tetracycline resistance, but it needs to be given for a longer time and possibly higher doses than standard. If *Ureaplasma urealyticum* and *Ureaplasma parvum* are suspected or diagnosed, Erythromycin or Tetracycline is usually the first line therapy.

Chronic Disease Association

Various Mycoplasmas have been found associated with chronic diseases such as Lyme Disease, Alzheimer's, fibromyalgia, Gulf War Syndrome, multiple sclerosis, chronic fatigue, AIDS, ALS, and some cancers.

In the case of Lyme, most doctors don't know to test for it. Many who do test find that a large percentage of their Lyme patients have it. Added to the other co-infections that many Lyme patients have, this further complicates treatment, although many of the antibiotics used to treat Lyme and other co-infections also work to kill Mycoplasmas.

If you search online for references to Mycoplasma, you're sure to run across the name of Dr. Garth Nicolson, who's done extensive research on this microorganism. Find more about Dr. Nicolson's work and publications at <http://www.immed.org>.

http://www.immed.org/illness/gulfwar_illness_research.html

Lyme Disease

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Lyme disease is a serious and often devastating illness. The usual cause is the bite from a tick infected with the *Borrelia burgdorferi* spirochete carried by mice, deer and other warm-blooded animals. The *B. burgdorferi* spirochete is an anaerobic bacterium. That is, it cannot exist in oxygen. Reproduction of the spirochetes is thought to be inhibited by an increase in O₂ levels. Oxygen at an elevated partial-pressure effectively saturates all tissues and crosses the blood-brain barrier. The benefits of such penetration depend upon the sensitivity of the spirochete to the elevated levels of O₂.

Multiple Sclerosis, fibromyalgia and chronic fatigue syndrome are among many conditions in which symptoms closely resemble Lyme disease, thereby making Lyme difficult to diagnose. Fibroblasts tend to protect the spirochete against antibiotics making a diagnosis and treatment plan complicated and individualized. Living spirochetes have been found in a muscle biopsy after a year of IV antibiotic treatments.

Most patients treated with Hyperbaric Oxygen (HBO) experience an exacerbation of symptoms called a Herxheimer response, believed to be caused by the toxins unleashed as the spirochetes die off. The Herxheimer usually diminishes in severity. Many patients have reported a significant (sometimes even total) decrease in symptoms over a period of time, even after stopping antibiotic treatments.

Prior to the initiation of HBO treatments, patients must have a physician's order, sign a waiver and release, complete a symptom survey, and are oriented to the treatment. 30 to 40 treatments, 1 to 2 times per day, are the current recommendation. With the exception of temporary ear discomfort as explained in the Hyperbaric literature, Lyme patients may also experience the temporary Herxheimer. No other adverse reactions are expected. Patients are requested to continue follow-up care with their personal physicians.

Since HBO treatment is still in the experimental stages for Lyme, insurance reimbursements may or may not be available.

Reference:

The Text Book Of Hyperbaric Oxygen Medicine, By K.K. Jain MD

Hyperbaric Oxygen Therapy, By Dr Richard Neubauer MD

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Hyperbaric Oxygenation for Polyneuropathy, and Lyme Disease a case report

A 41 year old female, presented a history that included a diagnosis of Lyme Disease since August 1995. Her medication consisted of long term oral antibiotic cephadrine and IV antibiotic vancomycin along with percodan for pain control. She had several acute medical episodes in 1998, prior to receiving hyperbaric oxygen therapy, that involved bilateral distal Parathesia, muscle weakness, intermittent flaccid paralysis that included what was called bipolar Bell's Palsy and she had intermittent loss of Consciousness. Several of these episodes required hospitalization. One Episode required intensive care for respiratory failure June 19, 1998. She was placed on mechanical ventilation for 15 hours. Spinal tap showed protein but no cells in the CSF. Around this time she had intermittent bilateral lower extremity motor loss requiring wheel chair support. While the prior medical regime addressed the Lyme infection the later condition involved several acute episodes of polyneuropathy.

At the time of her presentation to the hyperbaric facility she was ambulatory without support but walked with postural kyphosis approaching full flexion. Muscular weakness made it difficult for her to stand upright. She had constant daily migraine headaches. She said she did not sleep well as her memory of waking in the hospital with the mechanical ventilation scared her such that she feared going to sleep and having respiratory arrest again. She was taking oxycodin for pain control. She had a history of cigarette smoking. Social history: married, no children.

Hyperbaric oxygenation was started on August 18, 1998 at 22 psig (2.5 ata abs) twice per day for 60 minutes at full pressure each session, six days per week for the first two weeks, five days per week thereafter. Patient used oxygen hood at full pressure and kept hood on for most of the decompression.

After 75 sessions the patient reported that "something clicked" and her headaches were gone, pain and motor loss were gone, energy resumed and she "got her life back". Her posture was no longer kyphotic and she was able to smile during conversations. She continued HBO2 twice per day (2.0 to 2.38 ata abs) and during her 122nd session reported that her "hand tingling" disappeared. She resumed long walks and started helping other people with their own difficulties. Her headaches cleared.

She reported sleeping better and lost her fear regarding respiratory arrest. She said she was more comfortable inside the chamber than anywhere else. Her treating medical physician, who initially did not recommend hyperbaric oxygenation, expressed wonder at C.P.'s improvement and now thinks HBO2 is a good therapy. The only reported side effect was some noticeable myopia that stabilized after 80 sessions. After that time the patient reported her overall vision improved.

Discussion:

Lyme complications often involve neurological complications such as polyneuropathy. (ref. # 2-5). Bilateral distal sensory and motor disturbance progressing to the cranial nerves with impaired respiration presents a polyneuropathy that can be life-threatening. Unrecognized tissue hypoxia, especially after episodic respiratory failure, further complicates this chronic disease condition. Hyperbaric oxygenation therapy was applied over a prolonged time to compare the outcome over several months as earlier studies showed promise (ref.#1). This patient responded well after 75 sessions and continued improving to full function up to 144 sessions. The impact on her social well being transformed her from weak and dependent to outgoing and helpful. The temporary side-effect of myopia was minimal compared to the

overall improvement. The per session cost averaged about \$85 each including a subsidized portion from a charity fund.

After looking at this particular treatment cost compared to the years of debilitation, social loss and medical bills in this chronic condition one may conclude his HBO2 therapy was cost effective and useful.

References:

1. Ter Arkh 1986;58(7):105-9 [Place of hemocarboperfusion and hyperbaric oxygenation in the treatment of patients with rheumatoid arthritis with systemic symptoms]. [Article in Russian] Saikovskii RS, Alekberova ZS, Dmitriev AA, Ashurova LL, Mach ES HBO2 is appropriate in such systemic symptoms as ischemic polyneuropathy, digital arteritis, trophic ulcers and Raynaud's syndrome.
2. Muscle Nerve 1997 Aug;20(8):969-75 Detection of Borrelia burgdorferi DNA and complement membrane attack complex deposits in the sural nerve of a patient with chronic polyneuropathy and tertiary Lyme disease. Maimone D, Villanova M, Stanta G, Bonin S, Malandrini A, Guazzi GC, Annunziata P Institute of Neurological Sciences, University of Siena, Italy. We report a patient who developed a chronic sensory-motor polyneuropathy and a progressive myelopathy 4 years after a tick bite. The presence of complement membrane attack complex deposits and macrophage infiltrates around epineurial vessels and within the endoneurium suggests that the neuropathy in our patient was immune-mediated.
3. Am J Phys Med Rehabil 1996 Jul-Aug;75(4):314-6 Lyme borreliosis neuropathy. A case report. Deltombe T, Hanson P, Boutsen Y, Laloux P, Clerin M Department of Physical Medicine and Rehabilitation, University Hospital of Mont-Godinne UCL, Yvoir, Belgium. Lyme borreliosis is responsible for a large variety of peripheral neurologic manifestations including axonal polyneuropathy, radiculopathy, and facial nerve palsy.
4. Enferm Infecc Microbiol Clin 1996 Feb;14(2):72-9 [Frequency of the clinical manifestations of Lyme borreliosis in Spain]. [Article in Spanish] Guerrero A, Escudero R, Marti-Belda P, Quereda C Unidad de Enfermedades Infecciosas, Universidad de Alcala de Henares, Madrid. Neurological manifestations were presented by 40 patients (62.5%) (in control group 23%, $p < 0.05$) cutaneous lesions by 20 patients (31%), articular manifestations by 18 patients (28%) (in control groups 56%; $p < 0.05$) and cardiac manifestations in two. Cutaneous manifestations included 17 erythema migrans, 2 acrodermatitis chronica atrophicans and 1 lymphocytoma). Arthritis was present in 18 cases. Neurological manifestations included 16 cases of meningitis (2 with encephalitis), 11 of cranial neuropathy and 25 of peripheral neuropathy (13 of polyneuropathy).
5. #5 N Engl J Med 1990 Nov 22;323(21):1438-44 Chronic neurologic manifestations of Lyme disease. Logigian EL, Kaplan RF, Steere AC Department of Neurology, Tufts University School of Medicine, Boston, MA 02111. Lyme disease, caused by the tick-borne spirochete Borrelia burgdorferi, is associated with a wide variety of neurologic manifestations. To define further the chronic neurologic abnormalities of Lyme disease, we studied 27 patients, in 16 patients electrophysiologic testing showed an axonal polyneuropathy.

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Hyperbaric Oxygen Therapy for the Treatment of Lyme Disease.

Fife W.P. and Freeman D.M. Preliminary Clinical Study College Station, Texas: Texas A&M University Hyperbaric Laboratory, 1997.

Forty patients with Lyme disease were treated with HBOT 5 days per week for approximately 4 weeks. All but 2 cases improved, and improvement persisted after HBOT was discontinued, even when they discontinued antibiotic therapy.

Symptoms that improved included mental confusion, pain, depression and fatigue. This was a pilot study and has not been confirmed. HBOT must therefore be considered experimental in treatment of Lyme disease.

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Lyme Disease

Mitchell L. Hoggard, Pharm.

Opinion

(Father of a recovered Lyme Patient)

With respect to the comments about ATA pressure used in the treatment of Lyme Disease, the preferred depth is 2.36 ATA, which is not to say that that is the 'magic number.' It is true that angiogenesis may play a part because of the fact that the Lyme bacteria (Bb) can cause neuronal damage and possibly increase perfusion in those areas that are decreased. Thus, the use of HBO with respect to angiogenesis may be helpful in chronic neurologic Lyme. However, not involved in the process of killing the organism.

The Lyme bacteria is a microaerophilic organism, not an anaerobe, but certainly has been shown that it does not like elevated PO₂ levels above 70 to 80. Thus this may play a part in why the organism is not blood bound for the most part and finds its way primarily into the tissue where PO₂ levels are more in the neighborhood of 35 to 40.

It is theorized that HBO has the potential to kill by several mechanisms, one of those would be increasing tissue PO₂ levels, another would be a synergistic effect with antibiotic therapy, and another might be free radical formation.

With respect to Lyme, in the original Fife study 80% of patients showed significant reduction in symptoms or elimination all together. With respect to treatment protocol, I prefer 2.36 ATA to 2.4 ATA, two 1-hour treatments per day (based on bottom time), separated by 3.5 to 4 hours, five days per week.

Dr. Fife used 30 treatments as protocol and we certainly have found this to be effective in some patients. The primary reason for using at least 30 treatments, two treatments daily, five days per week, is that that equates to at least covering one life cycle of the organism-or close to it.

My experience, with far in excess of 200 Lyme patients treated with HBO, is that 40 to 60 hours of treatment is much more effective. I firmly believe that the treatment of Lyme does require a multi-disciplinary approach. That is to say analyzing the symptoms, reviewing previous treatment protocols, and including antibiotic therapy during HBO.

The response to HBO is a delayed response, typically, unless large numbers of treatments are involved (120 to 150 hours). By delayed response I mean improvements from HBO are usually not observed until three weeks to three months post-therapy.

Other treatment modalities should be considered post-HBO and antibiotics, such as the use of Actos and Cholestyramine therapies. The delayed response is likely due to the effect of the endotoxins created by the death of the bacteria, which we know to be LPS.

This substance is an immune response potentiator. In other words it stimulates cytokine storms such as TNF, IL-6, 8, 10 and others. Depending on the strain, the LPS may be quite fat soluble, which can slow elimination. Because they are eliminated into the intestinal track and some or all can be reabsorbed.

It is not the Lyme bacteria that are directly creating the entire problem, but indirectly from the endotoxins LPS and other substances like lipoproteins which also stimulate and effect immune response.

Not all individuals respond with HBO, just as not all individuals respond effectively to ABT. That is why it is important to keep in mind that Lyme treatment should be a multi-discipline approach to effectively create wellness or lessening of symptoms in chronic Lyme patients.

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High Pressure Oxygen Offers Hope For Lyme Disease, Post-Polio Syndrome

COLLEGE STATION-- Breathing high-pressure oxygen may provide relief from the often-crippling symptoms of chronic Lyme disease and post-polio syndrome, medical researchers say.

Two weeks of treatment with hyperbaric, or high-pressure, oxygen appears to provide relief -- apparently often permanent -- from the symptoms of chronic Lyme disease, researchers in Texas A&M University's Hyperbaric Laboratory told a meeting of the Southwest and Rocky Mountain Division of the American Association for the Advancement of Science Tuesday morning in College Station Tuesday (May 20).

Similar treatment with high-pressure oxygen appears to stave off muscle weakness, pain and stiffness associated with post-polio syndrome, a sometimes-crippling legacy of polio epidemics that swept the United States in the 1940s and 1950s, another Texas A&M hyperbaric researcher told the conference.

Student-researcher Alan T. Flanigan said a continuing study of people suffering from chronic Lyme disease suggests that hour-long doses of hyperbaric oxygen administered daily for two weeks will relieve the joint pain, neurologic symptoms and other complications of the tick-borne disease in most cases. Flanigan stopped short of claiming that the oxygen treatment cures Lyme disease, however.

The treatment relieves the symptoms of the disease, Flanigan said. He said the researchers suspect the oxygen may kill the *Borrelia burgdorferi* bacterium that causes Lyme disease, but current laboratory tests can't tell the difference between live bacteria and antibodies to those bacteria produced by the immune system.

Another student-researcher, David T. Walker, reported that treatment with high-pressure oxygen also relieves muscle weakness, pain and stiffness associated with post-polio syndrome, a condition that sometimes develops in people who contracted polio during epidemics of the 1940s and 1950s.

As many as 500,000 people in the United States are affected by post-polio syndrome.

Unlike the Lyme disease treatment, hyperbaric oxygen provides only temporary relief from post-polio syndrome, Walker said. Regular treatments must be continued or the symptoms reappear, he said. Many post-polio syndrome patients are able to resume almost normal activities, he said.

Physiologist William P. Fife, director of the Hyperbaric Laboratory, and physician Donald M. Freeman, Hyperbaric Laboratory medical director, supervise the Lyme disease and post-polio syndrome research.

Hyperbaric oxygen also is used to treat illnesses and injuries ranging from gas gangrene to skin ulcers, severely broken bones and, sometimes, so-called closed-head injuries. Treatment involves breathing pure oxygen while under the same pressure as Scuba divers experience under 45 feet of water.

Lyme disease's early symptoms often include a circular rash surrounding the tick bite, fever, headache and nausea. It is often effectively treated with antibiotics, but some patients don't respond to treatment. Untreated, symptoms can range from arthritis-like joint damage to neurological, psychological, heart and liver complications.

The disease has been reported in at least 34 states, including Texas. The federal Centers for Disease Control and Prevention call it the fastest spreading disease in the United States.

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An Overview of Lyme Disease and Hyperbaric Oxygen Therapy

Mitchell L. Hoggard and L. James Johnson

Authors' Note:

This article is an overview of Lyme disease and hyperbaric oxygen (HBO) therapy. We acknowledge that the medical areas we explore can be complex and that any attempt to define and explain them in a way that is not overly technical can be incomplete and/or inadvertently confusing. We have attempted to be both clear and exact. Mitchell L. Hoggard is a pharmacist. He is also President and founder of the Chico Hyperbaric Center.

All three of his children have received HBO therapy for Lyme disease. Mitchell Hoggard's son Ted was 14 years old when he took part in William Fife's HBO research study on Lyme disease (more on the study later). L. James Johnson, formerly a broadcast journalist, is now a marketing consultant. He has received extensive HBO therapy for Lyme disease.

We have written this article to focus attention on what medical science knows and what it does not know about Lyme disease and HBO therapy. A lack of clarity in the diagnosis and treatment of Lyme disease has impacted both of our lives and the lives of our families. Also, this article was written to be supportive to a patient's relationship with their physician—not to take the place of that relationship.

Information on how to contact the authors follows this article.

Lyme Disease

Lyme disease is a bacterial infection caused by a spirochete (spiral-shaped bacteria) called *Borrelia burgdorferi* (Bb). The bacterium is named after the person who discovered it, Dr. Willy Burgdorfer. Lyme disease is named after the Connecticut town of Lyme where it was first recognized in the United States in 1977. The first record of a condition associated with Lyme disease dates back to the 1880's.

Both humans and animals can be infected with the Bb organism through the bite of an infected tick. Over 100 strains of the bacterium that cause Lyme disease have been identified in the United States. Lyme infection is usually transmitted by, though not limited to, three species of tick:

- The black-legged tick (*Ixodes scapularis*) on the East Coast and in the Midwest (commonly known as the deer tick).
- The western black-legged tick (*Ixodes pacificus*) in the Western U.S. (also commonly known as the deer tick).

The lone star tick (*Amblyomma americanum*), located within a rectangle encompassing Texas, Florida, Rhode Island, and Iowa.

Lyme disease is also a global problem. There are reports that 300 bacterial strains of the Bb organism have been identified throughout the world. Cases of Lyme disease have been reported in North and South America, Europe, Asia, Africa and Australia.

Symptoms

Early signs of Lyme disease include flu-like symptoms (headache, fever, muscle aches, joint pain and fatigue) and a Lyme rash. Most symptoms show up days or weeks and occasionally months following infection.

The Lyme rash is referred to as erythema migrans or EM. It is important to remember that the rash may not show up at all, or it may appear too light in color to be noticed. The rash can be shaped like a bulls-eye, it can be smooth or bumpy, it may or may not feel warm, and there can be multiple rashes that can appear at the site of the tick bite or elsewhere on the body.

Once the infection becomes established, symptoms of Lyme disease vary but may include pain in muscles and joints, fatigue, swollen glands, fever, upset stomach, headache, forgetfulness, sleep disorders, depression, and sensitivity to light and sound, to name a few.

Lyme Confusion

The medical community is often perplexed by the highly individual and complex nature of Lyme disease. Some people experience Lyme disease as a minor illness that appears to be easily treated with antibiotic therapy without any long-lasting complications. Others are not as fortunate.

When Lyme disease goes undetected, undiagnosed and untreated for months or years following infection, the bacteria can spread to the nervous system, the heart and other organs, tendons and joints. This late-stage infection can result in a wide variety of physical, emotional, and mental or cognitive symptoms. The late-stage list of symptoms is long and can include arthritis, heart abnormalities, Bell's palsy (paralysis of one or both sides of the face) and severe cognitive or mental dysfunction including memory loss, confusion, psychiatric problems, etc.

Lyme disease is often referred to as the Great Pretender because the symptoms of Lyme disease can so closely mimic the symptoms of other diseases. Although no official numbers exist on this subject, Lyme patients have been misdiagnosed with chronic fatigue syndrome, fibromyalgia, multiple sclerosis, menopause, depression, Alzheimer's disease, and Lou Gehrig's disease. Other patients have failed to receive any kind of definitive diagnosis long after the presentation of symptoms.

Early Detection Is Paramount

Nearly all Lyme medical specialists agree that early detection and treatment of Lyme disease significantly improves the chance of a full recovery. Although not proven, some experts believe that there is up to a six to eight week window of opportunity following infection when treating the disease with antibiotic therapy can result in a high cure rate and lessen the chance of chronic, long-term problems.

It has been reported that it takes an average of 22 months and seven doctors for the average Lyme patient to be diagnosed with a Bb infection. This follows the fact that many people infected with Lyme disease do not remember being bitten by a tick, which can further delay treatment. The inability to diagnose and treat Lyme disease in a timely fashion may be adding to the number of patients who suffer from chronic symptoms.

It is estimated by some that as many as 20 percent of Lyme patients suffer from persistent and chronic symptoms. This figure may be too low. Obviously, more research would be helpful. However, what is clear is that the importance of early diagnosis and treatment cannot be over-emphasized.

Treatment

Lyme disease is a bacterial infection and like other bacterial infections it is treated with antibiotics. Antibiotics are administered orally, with intramuscular (IM) injections, or intravenously (IV) through the veins. Physicians often prescribe combinations of antibiotics to take advantage of the diverse ways that individual antibiotics affect the Bb organism.

Physicians not only prescribe more than one oral antibiotic at a time, but they combine oral antibiotics with IM or IV antibiotics. This shotgun (or multiple) approach to antibiotic therapy is used in hopes of affecting the Bb organism in as many ways as possible.

Just as no two Lyme patients appear to be affected by Lyme bacteria in the same way, a patient's response to antibiotic therapy is highly individual, too. The individual nature of an antibiotic's effect on a patient is believed to be due in part to the theory that different strains of the bacteria react differently to each antibiotic. Other factors may include the duration of infection, the amount of time between the onset of symptoms and treatment, and the location of the Bb organism in the body. Also, co-infections or the transmittal of more than one infectious disease, can occur from a single tick bite. This can make diagnosis and treatment more difficult still.

Co-infections

Co-infections may include more than one strain of the Bb organism and may include the tick-borne disorders of babesiosis and/or ehrlichiosis. Babesiosis and ehrlichiosis are also bacterial infections that present Lyme-like symptoms. However, treatment is often handled in a different manner from Lyme disease. Babesiosis requires a treatment program that is altogether different from antibiotic therapy for Lyme disease. Not all antibiotics that are used to treat Lyme disease are effective in treating ehrlichiosis.

Information on Lyme disease and co-infections is relatively new. It is highly recommended that those suffering from long-term, chronic symptoms be tested for babesiosis and ehrlichiosis if they have not already done so. Obviously, patients who have recently been diagnosed with Lyme disease should make sure that they are tested for co-infections, too.

It is our experience that many Lyme patients have not been tested for babesiosis and ehrlichiosis. This is a situation in which many patients, and health care professionals alike, have not yet adopted the most current medical practices.

Testing is a Problem

The diagnosis of Lyme disease remains clinically based—that is, a diagnosis based primarily on symptoms alone—because, unfortunately, there is no test available that is 100 percent accurate to rule out or confirm the infection. False positive results and false negative results are common. Accordingly, the patient's entire clinical picture is taken into account when diagnosing and treating Lyme disease.

We can better understand the lack of proper testing for Lyme disease by identifying the fact that there is not a common test that allows health care professionals to accurately determine if Lyme bacteria are present in the body. Amazingly, the lack of a common test also means that medical science cannot precisely determine whether someone is cured. This leads to contradictory treatment protocols and results in treatment guidelines that are more guesswork than many patients prefer, and less exact than many physicians and health insurance companies are comfortable with.

Science in general, and medical science in particular, prefers absolute and unmistakable testing, data and conclusions on which to base treatment protocols (or guidelines). Lyme disease was not recognized in the United States until 1977. Scientific research is lagging and there is much we don't know. Based on current scientific knowledge, the diagnosis and treatment of Lyme disease cannot be absolute and unequivocal. Instead—and no matter how unsettling this may be—until research catches up, the treatment of Lyme disease cannot be anything but subjective, open to question, individualized, and often complex.

Current Testing

The most common and current tests that are available today are limited to determining if antibodies to the Bb organism exist. The body creates antibodies after being exposed to the Bb organism. Lyme antibodies can remain in a person's body long after the Lyme organism has been eliminated. This means that a positive Lyme antibody test does not accurately indicate if active Lyme bacteria continue to be present in the body.

The ELISA and Western Blot tests are the most common tests currently used to confirm the presence of Bb antibodies. Current testing protocols were proposed in 1994 at the Second National Conference on Serological Diagnosis of Lyme Disease. A two-step process was established. The first step calls for a test such as the ELISA to be conducted. If positive, a Western-blot test is done in hopes of confirming that Lyme antibodies exist. However, even if Lyme antibodies exist, it does not mean that the patient has Lyme disease.

The Lyme Urine Antigen Test (LUAT) is a newer antibody test that is being used more frequently by Lyme physicians. As of this writing the Food and Drug Administration (FDA) has not approved the LUAT test for use in the clinical diagnosis of Lyme disease.

Further complicating matters is the fact that antibody tests can confuse Lyme antibodies with antibodies created by other complications in the body, including antibodies created in reaction to bacteria other than the Bb organism. This means that most of the current tests are not completely accurate. It also means that it is not uncommon to receive false positive and false negative results when using the ELISA, Western Blot or LUAT tests.

In other words, a negative test result cannot guarantee that Lyme antibodies do not exist. Conversely, a positive test result cannot guarantee that you actually have Lyme antibodies in your system. In both cases, accurate positive antibody test results do not mean that you even have active Lyme bacteria in your system. As we stated earlier, a positive antibody test result does not mean that you have Lyme disease.

The PCR Test

Two final notes on testing. First, some physicians use a Polymerase Chain Reaction (PCR) test to confirm that Lyme bacteria are present in the body. The PCR test is relatively new. It is designed to confirm that Lyme bacteria DNA are present. A positive PCR test almost always guarantees that you have Lyme disease, depending upon the accuracy of the lab that performed the work. However, because it can be difficult to isolate the Bb organism's DNA, a negative PCR test does not eliminate a Lyme disease diagnosis. The PCR test is usually more expensive than the ELISA, Western Blot or LUAT antibody tests.

The second note on testing has to do with the fact that test results often vary depending upon which lab performs the test. Some Lyme patients assume that testing for Lyme disease—and the test results—are uniform, standard and guaranteed. They are not. When we combine this fact with what we have already learned about testing for Lyme disease, it becomes obvious that the diagnosis of Lyme disease is not an exact science.

Jarisch-Herxheimer Reaction

A proper understanding of the Jarisch-Herxheimer reaction has helped Lyme specialists better manage the diagnosis and treatment of Lyme disease. This is especially true in light of inadequate testing. A Herxheimer reaction occurs in Lyme patients after they begin antibiotic therapy. It is important to note that a Herxheimer reaction is not a common reaction that is associated with most other diseases or with other viral, bacterial or fungal infections. A Jarisch-Herxheimer reaction is limited to a few specific bacterial infections such as syphilis and Lyme disease. It is interesting that syphilis and Lyme disease stem from spirochetal or spiral-shaped bacteria.

A Herxheimer reaction occurs when symptoms recur, flare up or become exaggerated. Some call it a healing crisis, while others describe it as getting worse before you get better. Lyme patients refer to this reaction as a herx, or say that they are herxing.

A Herxheimer reaction usually occurs within days to weeks of starting antibiotic therapy. When antibiotics directly kill Lyme bacteria or work with the body's immune system to kill the organism, toxins are released that cause either "direct reactions or indirect actions through stimulation of the immune system."5 In simpler terms, a Herxheimer reaction occurs when Lyme bacteria are killed off more quickly than the body's organs (kidneys and liver) are able to process them. This increases the number of toxins in the blood stream. The higher the toxin count, the more severe the symptoms the patient experiences.

Without accurate testing, the Herxheimer reaction is often used as a clinical diagnostic tool to help determine the presence of the Bb organism. It can also be used to confirm the effectiveness of specific antibiotics or combinations of antibiotics. Specifically, some health care professionals believe that a Herxheimer reaction can confirm that the Bb organism is present in the body by the fact that a bacteria die-off is causing the herx. Thus, for the frontline physician, the Herxheimer reaction can assist in the clinical diagnosis by unofficially confirming the presence of the Bb organism.

The Politics of Lyme Disease

This leads us to a pivotal and controversial issue that divides the medical community concerning the diagnosis and treatment of Lyme disease.

Some health care professionals are more tradition-bound and conservative in their approach to Lyme disease. They have adopted protocols for treating Lyme that don't go much beyond relatively short-term antibiotic therapy. This group believes that in almost all cases, one or two courses of oral antibiotics are all that are required to eradicate the bacteria. They believe that persistent, chronic Lyme symptoms are not the result of an ongoing infection—of active Lyme bacteria in the body—but rather, are probably the result of a dysfunctional auto-immune system response or some other process occurring in the body.

Others—especially those physicians who remain on the frontline of the long-term treatment of Lyme patients—believe that Lyme bacteria are not always eliminated by short-term courses of antibiotics. They believe that this is especially true if the disease went undiagnosed and untreated for months or years following infection.

Further, this latter group believes that the Bb organism can persist through months and even years of antibiotic therapy, depending upon a wide range of individual factors relating to the patient and to the strain(s) of bacteria. The survival characteristics of the bacteria themselves also play a crucial role in Lyme bacteria's persistent longevity.

Survival Tactics?

Research has shown that the Bb organism can use the body's own protein to encapsulate itself. 6 This is also described as the Lyme bacterium shifting to a dormant or sleeping state. The reason that the organism undergoes this change is not fully understood. Some believe that this is a survival tactic because it may not be possible for our immune system to destroy the bacterium when it is in this state. Also, antibiotics may have little or no effect on the Bb organism when it is encapsulated and dormant.

Research also shows that the Lyme bacterium appears to be able to enter certain types of human cells. This ability may also be considered a survival tactic because it results in the bacterium evading some or all antibiotics as well as the body's immune system.

Alternative Health Care

Antibiotics are the main tools that medical science uses to combat Lyme bacteria. However, it is our experience that many Lyme patients invest time, money and energy into exploring non-antibiotic, alternative health measures to treat Lyme symptoms. These can vary from taking supplements to visiting alternative health care practitioners. This area is much too large and diverse to explore in this article. Suffice it to say that Lyme disease is a highly individual ailment. Not only are symptoms experienced individually (and differently) by each Lyme patient, but every form of treatment (including antibiotic therapy) works differently for each individual. We do not know why this is so.

Most chronic Lyme patients have learned through experience that ultimately, it is their responsibility to manage their own health care. Many Lyme patients have made a conscious decision to explore alternative health care practices along with exploring conventional medical practices with their physician(s). We encourage responsible curiosity in both areas.

Antibiotics

Because antibiotics are the main tools that are used to fight Lyme disease, we can gain a better understanding of Lyme disease if we better understand how antibiotics affect the Bb organism. For a better understanding of how antibiotics work it helps to understand the mechanism of action they employ. Generally speaking, antibiotics fall into two categories:

- Bactericidal—An agent that directly destroys bacteria.
- Bacteriostatic — An agent that arrests or hinders the growth of bacteria.

Antibiotics that are bactericidal (for example, think... homicidal) can directly attack the cell wall of the bacteria. This causes a rupture and the death of the organism follows. Antibiotics from the penicillin family of antibiotics are usually bactericidal, unless concentrations fall too low.

Antibiotics that are bacteriostatic (for example, think... manipulative) do not directly attack bacteria. Instead, they interfere with the ability of the organism to reproduce. Without the ability to reproduce the bacteria can eventually die out. Bacteriostatic antibiotics include tetracyclines such as Doxycycline. It is important to remember that most antibiotics can be both bactericidal and bacteriostatic, depending upon the amount or concentration of the antibiotic in the body. More clearly still, most bacteriostatic antibiotics can become bactericidal if the concentrations are strong enough.

One of the main points to understand about bacteriostatic antibiotics is that they are usually effective in debilitating bacteria only when bacteria reproduce. This is significant for two reasons. First, it is believed that dormant Lyme bacteria don't reproduce, which diminishes bacteriostatic antibiotic's effectiveness in fighting Lyme disease. Second, Lyme bacteria have a long reproductive cycle. A mature Lyme bacterium reproduces once every 7 hours or so. This reproductive cycle may vary from species to species. In comparison, some species of the strep throat bacterium reproduce once every 20 to 30 minutes. It is not known how many reproductive cycles are needed before all Lyme bacteria are debilitated by antibiotics.

However, according to Karen Vanderhoof-Forschner in her book, *Everything You Need To Know About Lyme Disease*, the strep bacterium is normally treated with antibiotics through 480 reproductive cycles⁷. She says that if we were to treat Lyme disease through the same number of cycles it would take somewhere between 5 to 30 months of antibiotic therapy. If this is true, it is significant that some physicians follow a protocol for treating Lyme disease that allows just two to six weeks of antibiotic therapy. Based on the above scenario this may be inadequate.

If either of the above examples are true, this may mean that physicians who are acting in good faith by using conservative treatment protocols may actually be prolonging and thus complicating Lyme infection in their patients. However, much of this theory is speculative. Obviously, more research is needed.

Devastating Survival Tactic?

We have discussed how it is believed that Lyme bacteria primarily use two methods of invading the body's immune system and evading certain antibiotics. If the theory behind this belief is true then the two methods of evasion used by the Bb organism include:

1. The Lyme bacterium encapsulates itself in the body's protein (the cell wall membrane) and lies dormant for undetermined periods of time.
2. The Lyme bacterium hides by entering the body's cells.

In both cases the bacteria may be able to evade the body's specialized defensive mechanisms, along with evading the offensive mechanisms of antibiotics. However, the final piece of this puzzle has to be considered a genetic marvel no matter how devastating it is to Lyme patients. When Lyme bacteria shift from a dormant to an active state they can resume reproduction and effectively re-seed the body. This reestablishes the Lyme infection. If it is true that dormant bacteria can wake up and re-seed the body, this particularly devastating maneuver indicates that short-term courses of antibiotics may be ineffective in eradicating Lyme bacteria from the body.

Mechanism of Action

Antibiotics and other anti-infective agents (anything that counteracts infection) can kill different kinds of bacteria. However, an antibiotic's mechanisms of action—or how they kill bacteria—varies depending upon the type of antibiotic used. Because the mechanism of action varies among antibiotics and anti-infective agents, a specific antibiotic—or specific combinations of antibiotics—may be a better choice than other combinations when attempting to eradicate the Bb organism.

For example, Zithromax (azithromycin) is known to have higher tissue concentration levels when compared to the blood concentration levels it usually attains. Zithromax is also known to have an ability to penetrate some cells in our body more effectively than other antibiotics. This may have an added benefit when treating the Bb organism because we believe that Lyme bacteria have the ability to enter certain types of our cells.

Later, we will discuss in more detail why specific combinations of antibiotics work better than other combinations when treating Lyme disease. At this point we simply want to identify how the treatment of Lyme disease becomes a complex task with a myriad of options and protocols that are dependent upon an ever-widening circle of circumstances. As we stated earlier, until research catches up, the treatment of Lyme disease cannot be anything but subjective, open to question, individualized, and often complex.

Between a Rock and a Hard Place

While the medical community waits for research to help our understanding of how we can better detect the Lyme organism, frontline Lyme physicians are left with the question, "What is the best way to treat

chronic Lyme symptoms?" Many of these physicians emphatically state that their experience indicates that the effects of long-term antibiotic therapy are a lesser consequence compared to what life would be like for their patients if they were left untreated and the bacteria left unchecked in their system.

The Lyme controversy is fueled by the fact that current Lyme testing cannot definitively prove or disprove the presence of active Lyme bacteria in a person's body. Not having an accurate Lyme test forces physicians to rely on less than exact medical science. The alternative is to rely on no treatment at all. Thus, the controversy shows no sign of abating as long as testing methods that conclusively determine the existence of active Lyme infection remain unavailable to the frontline physician.

A final comment on Lyme disease. The medical community will continue to be perplexed and divided about Lyme disease until proper testing options become available. This has serious consequences for Lyme patients who are often left to fend for themselves in a confusing and contradictory medical environment. In an ideal world, people who are in various stages of illness—many of whom have been incapacitated by their Lyme symptoms—should not be put in this situation by a medical system whose purpose is to help, not frustrate their recovery.

Hyperbaric Oxygen (HBO) Therapy

HBO therapy is a medical treatment that uses the administration of 100 percent oxygen at controlled pressure (greater than sea level) for a prescribed amount of time—usually 60 to 90 minutes. HBO therapy is commonly used to treat conditions such as burns and difficult or stubborn healing wounds.

HBO therapy increases the amount of oxygen in the body, which in turn causes several physiological changes that can result in accelerated healing. The basis for these changes is the fact that HBO therapy increases the amount of oxygen in the blood by up to 2000 percent, depending on the treatment depth. This, in turn, dramatically increases the amount of oxygen at the cellular level and creates other physiological changes. These changes can be extremely complex. One scientific research study indicates that Lyme bacteria are microaerophilic, or debilitated in high oxygen environments.

In the case of Lyme disease, William Fife, Ph. D., a Hyperbaric Medicine specialist at Texas A & M University (now retired), established the protocols for HBO treatment in his Texas A & M research project, to be discussed later. Dr. Fife's Lyme disease protocol calls for HBO therapy to be administered at 2.36 ATA (Atmospheres absolute), or equivalent to a depth of 45 feet below sea level. Each treatment lasts one hour and two treatments are prescribed each day, five days per week.

The total number of treatments given in each case varies. It is common to administer 30 to 60 treatments in the first phase of treatment. The question of further HBO therapy is then resolved after the patient's condition is reevaluated. However, many believe that if the patient has been impacted by the first phase of HBO therapy, such as by experiencing a Herxheimer reaction (this can help to confirm Lyme bacteria die-off), then a break of three to six weeks should be taken followed by another 30 to 60 HBO treatments. A physician can prescribe more sets of HBO therapy based on the patient's individual evaluation.

Risks?

HBO therapy is a medical procedure and like any other medical procedure there can be risks. However, when HBO therapy is administered by trained health care individuals these risks are minimal. (As with any medical procedure, the evaluation and understanding of the current health status of the patient is of prime importance.)

Minor ear discomfort is the most common inconvenience related to HBO therapy. It is helpful to remember that the initial stage of each HBO treatment is similar to sitting in an aircraft while it descends. Like the airline passenger, the patient's ears have to adjust to a change in air pressure. The hyperbaric

health care professional works with the patient or parent and teaches them various techniques on how to equalize pressure in the ears, such as swallowing.

If one cannot equalize the pressure in the ears, damage can occur to the eardrum. However, this is very rare. Some individuals who experience ear discomfort may require a procedure called a Myringotomy, or what is commonly called placing tubes in the ears. An ear, nose and throat specialist usually performs this outpatient procedure right in the doctor's office.

Other complications can occur if a patient has lung abnormalities such as emphysema. However, with proper evaluation prior to HBO treatment any concerns can be eliminated.

A Promising Therapy

Why does HBO therapy show promise in helping Lyme patients? First, we are reminded that Lyme bacteria are microaerophilic, or debilitated in high oxygen environments. Research by F. Austin demonstrated the effect of oxygen on the Lyme organism. The study suggests that the Bb organism is sensitive to high concentrations of oxygen at the cellular level, or what is termed, elevated tissue partial pressures. In other words, the Bb organism doesn't do well in a biological environment similar to that created in the body during HBO treatment.

Once it was clinically determined that Lyme bacteria may be adversely affected by the conditions created in the body during HBO therapy, the next step was to conduct a more in-depth study. One such subjective study was completed in 1997 by William Fife, Ph. D. at the Texas A & M Hyperbaric Laboratory and approved by the Texas A & M University Review Board.

The results of the study were significant: improvement in approximately 85 percent of the 66 patients treated. Improvement is defined as a decrease or the elimination of symptoms. (See the outline of Dr. Fife's study, Effects of Hyperbaric Oxygen Therapy on Lyme Disease under the treatment section at HBOTODAY)

It is also notable that all of the study's participants were veterans of antibiotic therapy. These were adults and children who had tried and failed antibiotic therapy, including the big gun in the antibiotic arsenal: intravenous antibiotics. It appeared that the study had chosen the most difficult subjects to test. These were Lyme patients with chronic symptoms and most of them probably had nothing to lose. The fact that 85 percent of these Lyme patients showed improvement seems remarkable.

Other Benefits of HBO Therapy

There are other benefits of HBO therapy that may play a role in treating Lyme disease, but were not mentioned in the Texas A & M study. Some of these benefits are theoretical and not proven; others are well known and considered established fact in Hyperbaric Medicine. Many of these additional benefits are based on the belief that HBO therapy and antibiotic therapy work in a synergistic manner. In this context, synergistic is defined as the combination of both treatments (HBO therapy and antibiotic therapy) being greater than the effect of either one alone. First, let's review.

Earlier we discussed how antibiotics and the immune system might not be able to adversely affect (or kill) Lyme bacteria for two distinct reasons. First, it is believed that the Bb organism is able to switch from an active to a dormant (or sleeping mode) by coating itself in the body's protein. It is also believed that the Bb organism can hide in the body's cells. Both tactics may result in the immune system failing to react to the Bb organism as a foreign organism that should be destroyed. Some believe that this has the effect of neutralizing the body's defensive mechanisms and the offensive mechanisms employed by antibiotics.

Complicated Therapy

Lyme physicians take all of this relatively new knowledge about bacterial biology into account when deciding which antibiotic, or combination of antibiotics to prescribe. The above scenario suggests that, depending upon dosage, some classes of antibiotics such as penicillins and cephalosporins may not be able to eradicate Lyme bacteria from the body because they circulate mainly in the body's fluids and are incapable of entering cells where the Bb organism can reside. If true, this contradicts many current conservative antibiotic protocols for Lyme disease.

The good news is that other classes of antibiotics, such as macrolides (azithromycins such as Zithromax) are prescribed specifically to attack the Bb bacteria that may become established within the body's cells, along with killing Lyme bacteria residing outside the cells in deep tissue areas of the body.

It is important to recognize that this is a case in point where a shotgun approach to antibiotic therapy may be an effective tool in fighting Lyme disease. For example, a physician may prescribe a penicillin such as Amoxicillin, along with a macrolide such as Zithromax. The Amoxicillin stays mostly in the body's fluids and blood stream. Meanwhile, Zithromax not only penetrates the cell wall where the Bb organism is residing (and/or hiding), but it also penetrates deep tissue areas, which Lyme bacteria also inhabit. When Lyme bacteria move to deep tissue areas they have effectively moved away from normal blood flow and away from fluid-based antibiotics. Antibiotics such as Zithromax can help to counter this survival tactic.

Also, Amoxicillin is mainly bactericidal (remember, think... homicidal), which means that it directly kills the Bb organism. Zithromax is a macrolide, which means that it can either be bactericidal or bacteriostatic (think... manipulative) depending upon concentration levels. By prescribing these two antibiotics, physicians hope to increase the opportunities for killing as many bacteria as possible, and affecting Lyme bacteria in numerous and complex ways. Obviously, physicians prescribe many other combinations of antibiotics to combat the Bb organism.

Even though physicians can out-manuever some of the Lyme bacterium's survival tactics—such as using combinations of antibiotics—there are those who believe that antibiotics probably cannot eliminate the Bb organism if it is in a dormant state. Again, if this is true, it has serious consequences for the diagnosis and treatment of chronic, persistent symptoms. Specifically, this means that conservative treatment protocols, which call for short-term courses of antibiotics, may actually prolong some cases of Lyme infection. If chronic Lyme symptoms are the result of an active, late-stage Lyme infection, any delay in full and comprehensive antibiotic treatment may have devastating results for the Lyme patient.

Adding HBO Therapy

Now we add HBO therapy to the mix. We previously stated that Dr. Fife's study suggests that the Bb organism is sensitive to elevated levels of oxygen at the cellular level. This is an environment similar to that created in the body during HBO therapy. Unfortunately, at this time we do not know much about HBO's effect on dormant Lyme bacteria. However, Fife's study conclusively showed that HBO therapy does have a significant and positive impact on a high percentage of Lyme patients who failed antibiotic therapy. The exact reasons why this is so are not clear.

It is interesting to note that some believe that HBO therapy can kill the Bb organism directly. This begs the question, "Can HBO therapy directly kill the Bb organism on its own?" It seems possible that the answer to this question may be yes. A positive response seems reasonable because Lyme patients who have undergone HBO therapy without taking antibiotics seem to have experienced a Herxheimer reaction during treatment. This suggests that HBO therapy alone was responsible for the bacteria die-off. If true, HBO therapy would indeed be capable of killing the Bb organism directly. Again, more research would be helpful.

Angiogenesis Plays a Role

HBO therapy facilitates angiogenesis. Angiogenesis is defined as the development of blood vessels in the body. This may become important in the treatment of Lyme disease because it is believed that Lyme bacteria effectively evade antibiotics by moving away from normal blood flow into tissue, organs and bone. Thus, the farther that the antibiotic can move into these areas through a more dense and extensive system of blood vessels, the greater the opportunity to kill the Bb organism. HBO therapy's facilitation of angiogenesis allows the antibiotic to potentially have a greater effect on Lyme bacteria by helping to move the antibiotic closer to those parts of the body where the bacteria may be residing.

Bacterial Cell Wall Penetration

There is emerging evidence that certain antibiotics may be more readily incorporated into the cell wall of the bacteria itself in the presence of elevated oxygen tension, which is an environment similar to that created in the body during HBO therapy. If true, this is a clear example of HBO therapy working in a synergistic manner with antibiotic therapy. In other words, the effectiveness of antibiotics to kill the Lyme organism is increased through the use of HBO therapy.

Research is currently being conducted that may indicate that the Bb organism can be killed by oxygen free radicals. Oxygen free radicals are produced during HBO therapy. The deeper the depth of treatment, the greater the number of free radicals produced. It is believed by many that oxygen free radicals have an antibiotic-like effect.

Finally, it is well understood that HBO therapy can enhance certain aspects of the body's natural immune system. This may play a significant and positive role for Lyme patients because their immune systems have probably been compromised over a long period of time as a result of persistent symptoms.

Further Research

The benefits of HBO therapy appear to be far reaching, as well as having particular significance for Lyme patients. However, further research would be helpful in establishing better diagnostic testing procedures for Lyme disease and precise protocols of treatment for HBO therapy. The former obviously includes a precise test to directly measure the presence of Lyme bacteria in the body, or absence thereof. The latter includes the ideal total number of HBO treatments (and their depth) necessary to treat Lyme disease.

It would also be helpful to better understand the exact mechanism of action that occurs in HBO therapy. After all, Dr. Fife's study showed improvement in 85 percent of the 66 patients who were monitored during his Lyme disease/HBO therapy research study. Simply, it would be helpful to understand precisely why so many Lyme patients got better.

In general, a better understanding of the Lyme bacterium will enable us to develop new and better methods of treating this devastating disease.

In Conclusion

This article has attempted to use current scientific knowledge to inquire into, and to speculate on possible explanations of why HBO therapy is helpful for some Lyme patients. As we stated earlier, just as the diagnosis and treatment of Lyme disease is "subjective, open to discussion, individualized, and often complex," we acknowledge that this article has been subjective and it should be open to question. However, we also feel that no stone should be left unturned in society's effort to understand a disease that has done the following three things:

1. Devastated so many individual lives.
2. Strongly impacted so many families.
3. Afflicts an untold number of people around the world.

We know that antibiotic therapy helps some people who suffer from Lyme disease. We don't fully know why this is so. We also know that HBO therapy helps some people who suffer from Lyme disease. Again, we don't fully know why this occurs. In both cases we feel that it is important to learn why each of these treatments work for some people and not for others.

However, we believe that the major focus of medical science should be on developing an accurate test for Lyme disease. Such a test will do more to eliminate the current controversy and confusing protocols surrounding the diagnosis and treatment of Lyme disease than anything else will. Clarifying better ways of diagnosing and treating Lyme disease through more accurate testing methods will go a long way toward relieving the suffering that many Lyme patients continue to endure.

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Review of treatment options for Lyme Borreliosis.

Taylor RS, Simpson IN.

Micron Research Ltd, Ely, UK. rod.

Lyme borreliosis (Lyme disease) is the most common tick-borne bacterial infection and the incidence is increasing in parts of Europe and the USA. Prompt antimicrobial therapy using oral agents such as doxycycline or amoxicillin is successful among more than 90% of patients. Inadequate penetration of oral agents into the CNS may result in the development of overt neuroborreliosis. The parenteral agent ceftriaxone is the drug of choice for severe acute and chronic infections, due to good penetration into CSF, convenient single daily dosage regimen and proven high efficacy in clinical trials involving a wide variety of disseminated infections. Regardless of therapeutic agent, there appears to a small minority of patients (<10%) who do not respond; such cases may be due to long-term persistence of borrelial cysts and to misdiagnoses based solely on seropositivity.

Several adjunct therapies are available, including Hyperbaric Oxygen Therapy and immune system supplements.

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Effects of Hyperbaric Oxygen Therapy On Lyme Disease

By William P. Fife, Ph. D.
29 January 1998

The purpose of this study was to determine if hyperbaric oxygen therapy affected Lyme disease caused by the spirochete, *Borrelia burgdorferi*.

The spirochete *B. burgdorferi* is a microaerophilic organism carried by the Deer tick (*Ixodid*) and transferred to humans and other mammals by its bite. Symptoms often begin by a bulls-eye rash and erythema migrans. Symptoms may include pain in joints and muscles, sore throat, fever, swollen glands, and mental "fogginess". If not diagnosed within the first one or two months, the disease may become a

chronic infection. At that time it apparently becomes sequestered in fibroblasts and other cells which, in turn appear to protect it against effective treatment by all known antibiotics so far tested. The disease is difficult to diagnose without serological findings and requires the skill of a highly qualified physician, experienced in treating this disease.

Rationale:

It was shown by Austin that the spirochete could not survive if transferred in air to another host, but would survive if transferred in a gas mixture of 4% oxygen. This demonstrated that the spirochete could not survive in an oxygen partial pressure of 160-mm Hg (the partial pressure of oxygen in air), but could survive in a partial pressure of 30-mm Hg (which is the partial pressure of 4% oxygen at 1 atmosphere, absolute (ground level pressure)). Therefore, it seems clear that a lethal level of oxygen for the spirochete falls somewhere between 30 mm Hg, and 160 mm Hg.

It also is known that while the inspired partial pressure of oxygen is approximately 160 mm Hg, at the tissue level, the partial pressure of oxygen normally is approximately 30-35 mm Hg. Thus, it would not be expected that breathing air at ground level would cause any damage to the spirochete. However, if the patient were placed in a hyperbaric chamber and the pressure increased to 2.36 atmospheres, absolute (ata), the total barometric pressure would be 1794 mm Hg. If the patient were then to breathe pure oxygen the inspired partial pressure of oxygen would be 1794 mm Hg. Inspired oxygen is diluted by carbon dioxide and water vapor in the alveoli, so that the arterial blood would be exposed to an oxygen partial pressure of approximately 1700-mm Hg, and the tissue oxygen would be between 200 and 300 mm Hg. This clearly would be above lethal oxygen levels for the spirochete since it is expected that oxygen normally would diffuse throughout all cells of the body.

This partial pressure of oxygen can be safely achieved in a hyperbaric chamber, and the patients can tolerate this level for 90 minutes or longer quite successfully.

Protocol:

This study was approved by the University Institutional Review Board.

Subjects were selected from those referred by clinical physicians who were experienced in the treatment of Lyme disease. All subjects presented with a positive diagnosis of this disease according to the CDC criteria, including a positive Western blot serology of the proper bands. All had failed intravenous antibiotics, and many were continuing to deteriorate even though still on various antibiotics.

Subjects were given a briefing on the use of the hyperbaric chamber, including the risks, and signed a waiver and release in accordance with the Belmont Report. They were placed in the multiplace chamber and compressed to 2.36 ata, whereupon a plastic helmet was placed over the head and pure oxygen was administered. The oxygen flow pattern was such that the subject inspired 100% oxygen with each breath. Subjects were able to communicate with the attendant in the chamber as well as with each other.

Treatment duration was 60 minutes on oxygen, and in most instances the treatments were administered bid for 5 days followed by a two-day rest. Several different series were tried, ranging from 10 treatments to 30 treatments. One subject received 145 treatments over the course of 3 months.

Results:

Ninety-one subjects completed a total of 1,995 hyperbaric oxygen treatments, although nine were eliminated later due to the presence of another medical problem not apparent during their treatments. These other medical problems were such things as babesiosis, ehrlichiosis, hepatitis C, and previously unidentified neurological problems. Two subjects were eliminated due to the development of septicemia

from IV catheters, and one because of recent breast cancer, although all three of them later showed an improvement of Lyme symptoms with hyperbaric oxygen administration.

Subject evaluation was carried out by an abbreviated questionnaire taken from a standard questionnaire used by several Lyme specialists as part of their evaluation. This questionnaire was designed so that zero reflected no symptoms, while ten reflected severe symptoms.

Although additional statistical evaluation still is being carried out, it appears that approximately 84.8% of those treated showed significant improvement by a decrease or elimination of symptoms. Only 12 subjects (13.1%) claimed no apparent benefit.

Before treatment, the subjects had an average score of 114.12 (of a possible 270), and after treatment they averaged 49.27. This reduction of 64.85 points was statistically significant in a paired t-test ($p=0.000$). The variability of the scores from patient-to-patient declined as well after the treatment series. The standard deviation of the scores was 56.00 before and 44.14 after treatment. The p-value of this reduction is 0.057 in a Fisher's F-test. Further, 58% of the respondents had score reduction of 41.86 points or more.

All except one of the 91 subjects developed severe Jarisch-Herxheimer reaction, usually appearing within the first 5 days of the beginning of hyperbaric oxygen treatment. In most cases, the Jarisch-Herxheimer reaction continued throughout the series of treatments, and in many instances continued for up to a month after the treatments were finished. Most subjects then began to show major improvement that in some instances has continued for 8 months.

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New Evidence on Lyme Supports Extended Treatment

June 15, 2007

The International Lyme and Associated Diseases Society (ILADS) today announced that, for the first time, evidence supporting the ILADS position on the treatment of Lyme disease has been published in the journal *Clinical Infectious Diseases* (CID), considered one of the most prestigious publications in the field of infectious diseases and microbiology. It is the first time that evidence supporting the ILADS position has ever been published in an American infectious disease journal.

The duration of treatment for Lyme disease has been a contentious issue among physicians. The fact that two major medical associations - the Infectious Diseases Society of America (IDSA) and the International Lyme and Associated Diseases Society (ILADS) - have released conflicting guidelines for the diagnosis and treatment of Lyme disease has fueled the controversy.

"Publication of our recommendations about the most effective treatment for Lyme disease in a journal like CID is a milestone for ILADS," said Dr. Raphael Stricker, president of ILADS. "Doctors, patients and insurance companies need to know that the IDSA guidelines are flawed."

Difficult to Diagnose

A primary factor in the Lyme disease controversy is that the disease can be difficult to diagnose. Not every patient suffers from the typical "bull's-eye" rash and joint inflammation, considered classic symptoms of Lyme disease that is transmitted by the bite of a tiny tick. ILADS research indicates that only 50%-60% of patients typically recall a tick bite; the rash is reported in only 35% to 60% of patients; and joint swelling typically occurs in only 20% to 30% of patients. And given the prevalence of over-the-counter anti-inflammatory medication such as Ibuprofen, the joint inflammation is often masked.

Many patients with Lyme disease will continue to experience a variety of symptoms, even after the treatment recommended by IDSA. Some of these patients go on to develop multiple nonspecific symptoms, making it very difficult to diagnose chronic Lyme disease.

One reason for this difficulty is that *Borrelia burgdorferi*, the corkscrew-shaped bacteria that causes the disease, has an unusual genetic makeup. This allows the bacteria to screw its way into a variety of cells and evade the body's immune system. According to ILADS research, the Lyme bacteria invades multiple tissues and is able to assume a dormant state much like tuberculosis. This can make treatment much more difficult.

Extended Therapy

Based on extensive clinical evidence, ILADS maintains that extended antibiotic therapy for Lyme disease is sometimes necessary, particularly in later disease that is more difficult to eradicate. Studies have shown that *Borrelia burgdorferi* can persist after antibiotic treatment. In particular, studies conducted in animals - including mice, dogs and monkeys - indicate that the corkscrew-shaped bacteria can persist after treatment is completed. Persistence in humans has been confirmed by culture or molecular testing in at least a dozen studies.

"Science in this area is still evolving," according to Stricker. "We don't have all the answers and it is too early to adopt treatment strategies that assume we do. Meanwhile, doctors need flexible treatment approaches," he said.

The article describing the ILADS position on treatment of Lyme disease will be published in the July 15 issue of *Clinical Infectious Diseases*.

About ILADS

ILADS is a nonprofit, international, multidisciplinary medical society dedicated to the diagnosis and appropriate treatment of Lyme disease and associated tick-borne infections. ILADS promotes understanding of tick-borne diseases through research and education and strongly supports physicians and other health care professionals dedicated to advancing the standard of care for tick-borne diseases.

Source: PRWeb.com

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New Guidelines Issued for Nervous System Lyme

May 30, 2007

The American Academy of Neurology (AAN) has issued new evidence-based treatment guidelines for nervous system Lyme disease, which endorse conventionally recommended antibiotics for treatment of the disease, both for adults and children. However, they found no compelling evidence of a beneficial effect from the prolonged use of antibiotics in post-Lyme syndrome. The practice parameter, a report of the AAN's Quality Standards Subcommittee, is published online in the May 23 Expedited E-Pub issue and will appear in the July 3 print issue of *Neurology*. The document has also been endorsed by the Infectious Diseases Society of America. Evidence-Based Recommendations Lyme disease is caused by a tick-borne bacteria *Borrelia burgdorferi* and affects the nervous system in 10% to 15% of cases, a condition called neuroborreliosis.

Although guidelines exist in the diagnosis and treatment of Lyme disease in general, there is great variability in how neuroborreliosis is treated and little clear guidance is currently available, first author

John J. Halperin, MD, from Atlantic Health and Overlook Hospital in Summit, New Jersey, told Medscape. "It's something that causes a lot of consternation both for patients and physicians," he said.

To clarify recommendations for this document, the authors analyzed studies published between 1983 and 2003, using a structured review process to classify the evidence with a focus on answering 3 main questions: which antimicrobial agents are effective, whether some regimens should be preferred over others in different manifestations of nervous system Lyme disease, and, finally, the optimal duration of treatment.

"The first conclusion is that nervous system Lyme disease is very responsive to conventional antibiotics, and that conventional courses which run 2, at most 4 weeks, are quite effective," Dr Halperin said. There was sufficient data to conclude that in both adults and children, neuroborreliosis responds well to penicillin, ceftriaxone, cefotaxime, and doxycycline, the authors write, a level B recommendation. Dr. Halperin noted that in the United States patients are generally treated using intravenous antibiotics, as are most infections involving the nervous system. Although most of the studies in their review used parenteral antibiotics, they also drew on a "substantial body of literature" from European studies supporting the use of oral doxycycline.

They concluded consequently that, at least in patients with peripheral nervous system Lyme disease or central nervous system Lyme disease without parenchymal involvement, oral doxycycline is "probably a safe and effective treatment," also a level B recommendation.

For Lyme disease with parenchymal involvement, however, "most of us would be nervous using oral antibiotics and in those patients we recommend intravenous antibiotics," Dr. Halperin noted. Intravenous antibiotics are also recommended for patients with other severe neurologic symptomatology or who do not respond to oral regimens.

Finally, for post-Lyme syndrome, in which symptoms linger after there is no longer active infection, the literature indicates that prolonged courses of antibiotics are not effective and carry significant risk for adverse events, a level A recommendation.

Future Research Directions Their review of the evidence suggests areas where further research is needed, Dr. Halperin noted. The more straightforward question relates to the fact that the oral antibiotic data are entirely from Europe. "Although European Lyme strains are very similar to North American strains, they're not identical, so that work really should be repeated in North America," he said. "One of the things we'd all like to do if we had the time is a randomized trial of oral vs intravenous antibiotics for acute nervous system Lyme disease."

If oral doxycycline were shown to be effective, then assessment of the relative efficacy of other oral agents such as amoxicillin and cefuroxime axetil would also be helpful, the authors write. A far more challenging area for research is in creating a better understanding of the pathophysiology of post-Lyme syndrome. "It's clear the patients have symptoms that are very distressing and very disruptive to their lives and it's clear it's not infection, but it's not at all clear what it really is, and we need to figure out a way to answer that question," Dr. Halperin concluded.

The authors have disclosed no relevant financial relationships.

Clinical Context According to the authors of the current review, Lyme disease is a multisystem disease caused by a tick-borne bacteria *B burgdorferi* and can affect the nervous system, a condition called neuroborreliosis; however, there is considerable controversy about the approach to treatment of neuroborreliosis. In the United States, Lyme disease affecting the nervous system is generally treated with parenteral therapy, whereas in Europe comparable efficacy has been shown with oral doxycycline. Optimal duration of treatment has not been established, according to the authors. This is a literature review of studies on nervous system Lyme disease to identify best management strategies for antibiotics

and optimal duration of therapy and to outline approaches to post-Lyme syndrome. It was conducted by the Quality Standards Subcommittee of the AAN.

Study Highlights

- 37 articles were selected by independent reviewers on the panel after a search of MEDLINE, PubMed, and EMBASE databases using keywords identified 112 articles.
- Excluded were articles that were not peer reviewed, did not address treatment of neuroborreliosis, or were solely review articles.
- Studies were divided into areas of adult Lyme disease, pediatric disease, and post-Lyme syndrome.
- 4 studies were of class I; 4, class II; 4, class III; and the remainder, class IV evidence.
- Effects of Lyme disease on the nervous system were categorized as meningitis, cranial neuritis, and radiculoneuritis; parenchymal inflammation of brain and spinal cord; mild radiculoneuropathy and encephalopathy.
- Post-Lyme syndrome has been defined as a combination of chronic symptoms of fatigue, musculoskeletal pain, and neuropsychiatric symptoms in the absence of laboratory or clinical evidence of focal or inflammatory nervous system involvement.
- The data are sufficient to conclude that in adults and children, Lyme disease involving the nervous system responds well to penicillin, ceftriaxone, cefotaxime, and doxycycline.
- Ceftriaxone at a dosage of 2 g/day for periods varying from 7 to 30 days has been shown to be as effective as 4 g/day for Lyme meningoradiculitis and Lyme disease encephalopathy.
- None of the follow-up studies on efficacy included control patients.
- Good evidence supports the use of oral doxycycline at a dosage of 200 mg daily for 9 to 17 days for nonparenchymal nervous system Lyme disease as comparable to intravenous antibiotic regimens because of the excellent cerebrospinal fluid penetration achieved by doxycycline.
- There is a low probability of neurologic sequelae after doxycycline treatment of Lyme disease.
- For parenchymal involvement, severe neurologic symptoms, or failure to respond to oral therapy, parenteral antibiotic regimens may be associated with better outcomes than oral regimens.
- Some recommend routine cerebrospinal fluid examination of patients with Lyme disease who develop facial nerve palsy.
- There is no clear beneficial or harmful effect of using corticosteroids in patients with neuroborreliosis who are treated with appropriate antibiotics.
- In children, nervous system manifestations of Lyme disease include cranial neuropathies, headache, seizures, meningitis, meningoencephalitis, encephalopathy, focal neurologic signs, ataxia, vertigo, chorea, and transverse myelitis.
- Facial nerve palsy and meningitis are the most common manifestations.
- Treatment with either intravenous penicillin G or ceftriaxone has been shown to be effective.
- The etiology of post-Lyme syndrome remains uncertain, and persistent *B burgdorferi* infection is unlikely in patients who have been adequately treated with antibiotics.
- Antibiotics are not effective with respect to overall quality of life, depression, fatigue, and cognitive symptoms in double-blind placebo-controlled studies.
- Post-Lyme syndrome does not respond to prolonged courses of antibiotics and because such treatment may be associated with adverse effects, it is not recommended.

Pearls for Practice

- Lyme disease involving the nervous system responds well to penicillin, ceftriaxone, cefotaxime, and doxycycline in adults and children.

- The current literature review concluded that post-Lyme syndrome does not respond to prolonged courses of antibiotics and that because such treatment may be associated with adverse effects it is not recommended.

Source: Neurology. News Author: Susan Jeffrey

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Preliminary in vitro and in vivo findings of Hyperbaric Oxygen Treatment In experimental Bb infection

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In these studies, we evaluated repeated HBOT for its ability to kill Bb in vitro, and in vivo, in a murine model of Lyme disease. Several North American tick-derived and recently obtained patient isolates were studied separately in our assay systems.

To test for in vitro susceptibility, one-half to one million Bb were cultured in a small volume (0.1 - 0.2 ml) of BSK media using small snap-cap test tubes. With the caps removed, these cultures were then exposed, for one hour (twice daily for 2 consecutive days), to pure, filtered oxygen pressurized to 2-3 times normal atmospheric conditions. This was achieved using a specially constructed, miniaturized cylindrical chamber (length = 12 inches; diameter = 8 inches), equipped to accept any pressurized gas mixture through its portal opening. After the final HBOT, all cultures received an additional 0.5 ml of BSK media (making the final volume now 0.6 - 0.7 ml), and their caps were snapped shut. Matching control cultures received no HBOT. All cultures were incubated at 33°C for 2-3 days and were examined microscopically for live Bb.

Our results showed that 14 of 17 strains of Bb had their growth inhibited by 33-94%, while there was little or no inhibition of 3 Bb strains. For the in vivo studies, separate groups of C3H or CD1 mice were infected intra-dermally with 100,000 Bb. Two to 4 weeks later, one group of infected mice received two, 1.0-1.5 hour HBO exposures, for two consecutive or alternating days. The treated mice were sacrificed one day after the last treatment, and extract cultures of their urinary bladders were prepared in BSK media. It was found that no Bb grew out of 80% of these extract cultures, whereas live Bb organisms were recoverable from 90% of extract cultures prepared from matched, infected control mice not treated with HBO.

These data suggest that HBOT may be considered as a clinically useful form of adjunct therapy in the treatment of Lyme disease.

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