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Borrelia Burgdorferi, the causative bacteria in Lyme disease, is capable of transforming into three distinct bacterial forms: ***spirochete, cell-wall-deficient, and cyst***. This transformation occurs for the purpose of bacterial survival and proliferation in the human body.

Each form has different characteristics and vulnerabilities; hence, each form must be treated using a comprehensive integrative medicine approach.

Kills Lyme Germs: A Brief Antibiotic Guide

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Natural medicines: Otoba sp. (Banderol), Unicaria tomentosa commonly called cats claw (Samento), grapefruit seed extract

Prescription medicines: benzathine penicillin G (bicillin LA) , amoxicillin, amoxicillin/clavulanic acid (Augmentin), cefuroxime (Ceftin), cefdinir (Omnicef), ceftriaxone (Rocephin), ceftazidime (Zinacef), azithromycin (Zithromax), clarithromycin (Biaxin), doxycycline, minocycline, tetracycline, metronidazole (flagyl), tinidazole (tindamax), rifampin

I. OVERVIEW

Treating ***borrelia, the Lyme germ***, with antibiotics is complicated. There is limited research showing which treatment regimens work best. So many Lyme Literate Medical Doctors prescribe antibiotics based on a theory and our collective observation that combinations of antimicrobials work better than single agents alone. What follows is not definitive or comprehensive guide. Rather it reflects how we organize and put together an effective Lyme disease treatment protocol.

There are ***four rules*** used in developing an antibiotic regimen.

1. **Combine antibiotics to treat all forms of the germ.** Borrelia may exist in three separate forms. These forms are the **spirochete, a cell-wall deficient form also called the L-form, and a cyst form.** Some question if the L-form and the cyst form are the same. It is possible that borrelia can change itself from one form to another form. For instance, under the stress of an antibiotic treatment, the spirochete can convert to a more treatment resistant cyst form of the germ. ***At any one time, it is likely that a person with chronic Lyme disease has borrelia existing in all forms.***

2. **Combine antibiotics that work differently to attack the germ from different angles.** Families of antibiotics work differently. For instance the **penicillins** and **cephalosporins** (see below) work to ***weaken the outer covering of the spirochete*** while the **tetracyclines** and the macrolides ***limit the ability of the spirochete and l-form to grow by blocking protein production***.
3. ***Work with no more than three antibiotics at a time*.** **Recovering from chronic Lyme requires more than antibiotics**. An integrative medicine approach of diet, vitamins, acupuncture, chiropractic, IV vitamin therapy and oxygen therapies are critical to resuscitate the immune system following antibiotic therapies.
4. See section **IV. Special Considerations** below for information about:

II. ANTIBIOTICS ROUTINELY USED

(Note: This is not a comprehensive list of all antibiotics that can be used.)

PENICILLINS:

- **Types:** benzathine penicillin G (**Bicillin LA**), **amoxicillin**, amoxicillin/clavulanic acid (**Augmentin**).
- **Germ Forms Treated:** The spirochete and possibly the cyst.
- **Mechanism:** Works by limiting the growth of the cell wall matrix. This results in the covering of the spirochete breaking down. Eventually due to pressure inside, the germ bursts through its weakened cell wall and dies. It is not clear how penicillins treat cyst but research by Eva Sapi, PhD in the lab shows that amoxicillin does.
- **Available As:** Prescription medicine.

CEPHALOSPORINS:

- **Types:** ceftriaxone (**Rocephin**) 2gm, ceftazidime (**Zinacef**), cefuroxime (Ceftin), cefdinir (**Omnicef**)
- **Germ Forms Treated:** ***Spirochete***.
- **Mechanism:** Same as penicillins.
- **Available As:** Prescription medicine.

TETRACYCLINES:

- **Types:** ***doxycycline, minocycline, tetracycline***
- **Germ Forms Treated:** The spirochete and L-form.
- **Mechanism:** Blocks protein production at a part of the cell called the 30s ribosome. Ribosomes are located inside of cells where they use genetic programming and amino acids to produce proteins. When protein production is blocked germ growth is limited leading to eventual death.
- **Available As:** Prescription medicine

MACROLIDES:

- **Types**: **azithromycin** (**Zithromax**), clarithromycin (**Biaxin**), clarithromycin extended release (**Biaxin LA**)
- **Germ Forms Treated:** The spirochete and L-form.
- **Mechanism:** Blocks protein production at a part of the cell called the 50s ribosome. Ribosomes are located inside of cells where they use genetic programming and amino acids to produce proteins. When protein production is blocked germ growth is limited leading to eventual death.
- **Available As:** Prescription medicine.

AZOLES:

- **Types: metronidazole** (**Flagyl**), tinidazole (**Tindimax**)
- **Germ Forms Treated:** Spirochete (1), L-form, and cyst.
- **Mechansim:** Impairs bacterial enzymes and destabilizes DNA.
- **Available As:** Prescription medicine.

RIFAMYCINS:

- **Types: Rifampin**
- **Germ Forms Treated:** Cyst and possibly l-form and spirochete.
- **Mechanism:** Prevents production of RNA from the cell DNA. Without RNA the bacteria cannot make protein. When protein production is blocked germ growth is limited leading to eventual death.
- **Available As:** Prescription medicine

QUNINE Derivatives:

- **Types:** hydroxychloroquine (**Plaquenil**)
- **Germ Forms Treated:** None. Conflicting research shows could kill cyst or promote cyst growth.
- **Other Action:** Improves effectiveness of macrolides and tetracyclines.
- **Mechanism:** Lowers acid levels inside of cell vacuoles where germs can live. Lowering acid levels can help antibiotics work better.
- **Available As:** Prescription medicine.

GRAPEFUIT SEED EXTRACT:

- **Types:** Nutritional supplement
- **Germ Forms Treated:** Cyst.
- **Mechanism:** Unclear.
- **Available As:** Natural medicine.

COMBINATION HERBALS:

- **Types: Banderol** used with **Samento**. [Otoba sp. bark extract (**Banderol**) used with **Unicaria tomentosa** commonly called **Cats Claw** (Samento and various other products.)] Banderol and Samento should be used together.
- **Germ Forms Treated:** Spirochete, L-form, cyst.
- **Mechanism:** Unclear.
- **Available As:** Natural medicine.

III. ANTIBIOTIC COMBINATION EXAMPLES

This is a very limited list. There are many possible combinations.

Key Points: *Each combination*

- *Treats the three germ forms.*
- *Attacks the germ from different angles through different mechanisms of action.*

1. Macrolide plus Azole

- Clarithromycin (**Biaxin**) 500mg 2 times a day and **tinidazole** 500mg 2 or 3 times a day.

Key Point: Tinidazole *can remove biofilms that block the immune system and antibiotics.*

2. Macrolide plus Quinine Derivative plus Azole

- Azithromycin (**Zithromax**) 500mg 1 time a day, hydroxychloroquine (**Plaquenil**) 200mg 2 times a day, and metronidazole (**FLAGYL**) 500mg 2 or 3 times a day.

Key Point: Hydroxychloroquine (PLAQUENIL) *is used to increase the effectiveness of* ***azithromycin*** *which is generally not as effective as other macrolides like clarithromycin.*

Key Point: Tinidazole *could be* ***substituted for the metronidazole*** *because it may remove biofilms more effectively.*

3. Macrolide plus Grape Fruit Seed Extract

- Clarithromycin (**Biaxin**) 500mg 2 times a day and **grape fruit seed extract** 250mg 2 times a day.

Key Point: *Grape fruit seed extract is better tolerated than tinidazole and metronidazole and is fairly effective as an anti-cyst agent.*

4. Tetracycline plus Macrolide plus Grape Fruit Seed Extract

- **Doxycyline** 100mg 2 pills 2 times a day, clarithromycin (**Biaxin**) 500mg 2 times a day, and **grape fruit seed extract** 250mg 2 times a day.

Key Point: *Tetracyclines and macrolides both block protein production by binding to the protein production apparatus in germs called ribosomes. But they each bind to a different part of the ribosome improving the blockade of protein production.*

5. Penicillin plus Azole

- **Amoxacillin** 500mg 4 pills 3 times a day plus tinidazole (**Tindimax** 500mg) 3 pills 2 times a day for 2 weeks on and 2 weeks off of each 4 weeks.

Key Point: *This is a very high dose of* ***Amoxacillin*** *which is 4 times stronger than physicians prescribe for other infections like ear infections. I consider this dose to be nearly as effective as IV antibiotics (see* ***IV Equivalent Treatments*** *below.)*

Key Point: *This is a pulse dose regimen of the* ***tinidazol****e. It may be more effective than continuous regimens (see* ***Pulse Dosing*** *below.)*

6. Cephalosporin plus Tetracycline plus Azole

- Cefuroxime (**Ceftin**) 500mg 2 pills 2 times a day, **minocycline** 100mg 1 pill 2 times a day, and **Flagyl** 500mg 2 to 3 times a day for 2 weeks on and 2 weeks off of each 4 weeks.

Key Point: *Some experts suggest a tetracyline or macrolide in combination with a cephalosporin or penicillin could limit effectiveness. In theory cephalosporins and penicillins work best with rapid germ growth, but the tetracyclines and macrolides limit germ growth. Understand the theory, but in some this is a very effective combination.*

7. Herbal Combinations

- Otoba sp. (**Banderol**) plus Unicaria tomentosa commonly called Cats Claw (**Samento**). See Banderol and Samento on this site for dosing recommendations.

Key Point: *This combination is as effective as oral prescription antibiotic combinations.*
Key Point: *In addition to treating all three forms of the germ, this combination removes biofilms.*

8. Tetracyline with Rifamycin

- **Minocycline** 100mg 2 times a day plus **rifampin** 300mg 2 pills 1 time a day.

Key Point: *This is also an effective regimen for treating a* ***bartonella co-infection****. Co-infections are other germs passed on during a tick bite. If someone has a coinfection when possible I choose antibiotic combinations that treat Lyme germs and the coinfection germs.*

9. IV Antibiotic Regimen: Cephalosporin and Azole

- Ceftriaxone (**Rocephin**) 2gm IV 2 times a day for 4 days on and 3 days off plus **tinidazole** taken orally as 500mg 1 pill 2-3 times a day for 5 days on and 2 days off of each 7 days.

Key Point: *Various antibiotics can be used as IV. The* ***ceftriaxone*** *is given in a* ***syringe and injected over 10 min****. This is also a pulse dose regimen (see below under* ***Special Considerations****).* ***Ceftriaxone could be given daily instead as 2gm IV 1 time a day.***

Key Point: *Various pulse dose regimens of* **tinidazole** *work well. These include used as 2 weeks on and 2weeks off or in the regimen seen here.*

10. IV Antibiotic Regimen: Macrolide and Grape Fruit Seed Extract

- **Azithromycin** 500mg IV plus **grape fruit seed extract** orally 250mg 2 times a day.

Key Point: azithromycin works quite well as an IV antibiotic but is much weaker in oral form.

IV. SPECIAL CONSIDERATIONS

1. Antibiotics Alone Are Unlikely to Get You Well. You will need diet modification, oral and IV vitamin therapies, heavy metal detoxification, colon hydrotherapy, IV Oxygen therapies, Chiropractic/Acupuncture.

2. Pulse Dosing.

Some prescription antibiotics can be given using pulse dosing. The idea is to start and stop the antibiotics. This allows the body to recover from the toxicity of some of the drugs while providing effective killing of the germ using high doses. Lyme is a slow growing germ. The spirochete form only requires 2-3 days for some antibiotics to work and days to recover and to start growing again***. All of the antibiotics mentioned in this article can be pulse dosed except for azithromycin. One way to pulse is to use 4 day on and 3 day off regimen***s. Many physicians have different ways of pulsing antibiotics.

3. IV vs Oral Antibiotics.

Most oral antibiotic combinations work around 85% of the time while IV equivalent treatments work around 90% of the time. Thus the majority of people with chronic Lyme do not require IV antibiotics.

4. IV Equivalent Treatments.

Benzathine penicillin G (**Bicillin LA**) 1.2 million units given 3 to 4 times a week or high dose oral **amoxicillin** 500mg 3-4 pills 3 times a day is **nearly as effective as IV antibiotic regimens.** These treatment regimens deliver effective drug levels that penetrate tissues and the brain.

5. Treatment Length.

Treatment with antibiotics should be continued till you are well. For some this may mean complete recovery for others not. It is hard to predict at the beginning of a treatment for someone with chronic Lyme what the degree of recovery will be. Generally antibiotics should be rotated to prevent resistance to that antibiotic. **Generally, try to use an antibiotic for no more than six months**. Use various combinations of antibiotics during a treatment. ***Stop a full treatment when someone is either symptom free for 2 months or the improvements are plateaued for 4 months with no improvements seen after adjustments in the regimen.*** **On average it can take 2 years to recover for someone with chronic Lyme. This is an average. Some are on the 6 month program while others may require years.**

6. Remission.

For some with chronic Lyme disease cure does not occur.

7. Herxheimer Die-off Reaction.

About 90% of the time when antibiotics are started or changed during a treatment, a person will initially worsen. This is often due to a herxheimer die-off reaction.