

Flesh-Eating Bacteria Can Attack Those With Excess Iron

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STORY AT-A-GLANCE

- › Flesh-eating disease (necrotizing fasciitis) can be caused by several different organisms. In cases where the infection is contracted through contact with seawater, the culprit is typically *Vibrio vulnificus*, a particularly dangerous *Vibrio* species that occurs naturally in warm seawater
- › Having liver disease increases your risk of *V. vulnificus* infection by 800% and your risk of death from it is 200 times higher than those with healthy livers
- › Having diabetes, HIV, thalassemia or cancer also raises your risk of *Vibrio* infection, as does taking antacids
- › Iron overload may be a key factor in life-threatening *Vibrio* infections. High iron provides prime growth conditions for *V. vulnificus*, and minihepcidin, an iron-lowering drug, has been shown to cure the infection by inhibiting the bacteria's growth
- › *Vibrio* bacteria have a high affinity for attachment to human skin. In one study, all participants had *Vibrio* bacteria on their skin after swimming in seawater

This article was previously published July 30, 2019, and has been updated with new information.

The very idea of flesh-eating bacteria is horrifying and the real-world effects can indeed be devastating, necessitating the removal of large portions of flesh or amputation of limbs. Its effects can also be lethal. July 15, 2019, WGN9 News reported the case of a

woman being infected with flesh-eating bacteria after a quick swim at Norfolk's Ocean View beach in Virginia the week before.¹

She started feeling ill the very next day, and noticed symptoms of infection in her leg. It spread rapidly, and within a couple of days, she could no longer walk. Treating doctors suspect the bacterium made its way into her body via a small cut. She's currently recovering from leg surgery. Another Florida woman who contracted the infection is also on the path to recovery.²

Two other cases did not end as well. A man crabbing at Magnolia Beach in Texas, and another who went for a swim in the Gulf, contracted infections that led to their deaths.³

*"Health officials urge swimmers to avoid swallowing water and taking a dip after a heavy rainfall. Don't swim if you are ill or have a weakened immune system and swim away from fishing piers, pipes, drains and water flowing from storm drains onto a beach ... Once you get out of the water, health officials say you should shower with soap," WGN9 reports.*⁴

What WGN9 does not cover is evidence suggesting flesh-eating bacteria are ubiquitous in the ocean and on human skin after swimming in saltwater, and that the difference between those who come into contact with the bacteria and remain unaffected and those in whom the bacterium unleashes a dangerous infection is strongly related to their iron levels.

Another sad note is that this woman may have undergone needless surgery as this infection, and similar diabetic leg infections, are relatively easily treated in a hyperbaric oxygen chamber.^{5,6}

These types of infections typically require higher pressures with a hard-shell chamber⁷ and 100% pure oxygen with greater than two atmospheres of pressure — a treatment approved⁸ by the FDA for necrotizing infections, certain other wounds and gangrene. A soft-shell chamber would not likely be an effective treatment.

Necrotizing Fasciitis

Flesh-eating disease (necrotizing fasciitis) can be caused by several different organisms, although group A Streptococcus is responsible for a majority of cases. Group A Strep is also responsible for strep throat, rheumatic fever and scarlet fever.⁹

Death is typically related to sepsis and subsequent organ failure. Due to its rapid spread, it's important to seek medical attention as quickly as possible. According to the U.S. Centers for Disease Control and Prevention, early symptoms of necrotizing fasciitis include:¹⁰

- Redness and/or swelling that rapidly spreads
- Severe pain in the area and beyond (pain is typically described as worse than would be expected by the look of the wound)
- Fever

In particular, be on the lookout for skin discoloration such as black spots, ulcers or blisters on the skin, and/or oozing pus. Dizziness, fatigue, nausea and diarrhea are symptoms associated with heightened infection. According to the CDC's active bacterial core surveillance system, which tracks necrotizing fasciitis cases caused by group A Strep, the U.S. has averaged between 700 and 1,200 such cases per year since 2010.¹¹

Flesh-Eating Vibrio Infections Are Also Common

Now, in cases where the flesh-eating disease is contracted through contact with seawater, the culprit is typically the bacterium *Vibrio vulnificus*, a particularly dangerous *Vibrio* species that occurs naturally in warm seawater.¹² For this reason, it's not a good idea to go swimming if you have open cuts, sores or fresh tattoos.¹³

According to the U.S. National Oceanic and Atmospheric Administration,¹⁴ the *Vibrios* species prefer salty water above 59 degrees Fahrenheit (15 degrees Celcius). In fact, 93% of the time, the water temperature and salinity can correctly identify *V. vulnificus* hotspots. Iron- and nitrogen-rich dust settling in seawater has also been shown to fuel the bacteria's growth.¹⁵

According to the CDC, Vibrio infection (by all species) causes 80,000 illnesses and kills 100 people in the U.S. each year.¹⁶ Aside from seawater exposure, raw or undercooked seafood are other common routes of exposure.

Liver Disease Increases Risk of V. Vulnificus Infection

Importantly, having liver disease dramatically increases your risk of V. vulnificus infection. CDC findings reveal people with liver disease are a whopping 80 times more likely to contract V. vulnificus infection from raw oysters than those without liver problems, and 200 times more likely to die from it.¹⁷

Having diabetes, HIV, thalassemia (an inherited blood disorder that I actually have, which is associated with both anemia¹⁸ and iron overload¹⁹) or cancer also raises your risk of Vibrio infection, as does taking antacids.²⁰ These risk factors are worth considering when swimming in the ocean as well.

Preliminary, unpublished research presented at the 2019 annual meeting of the American Society for Microbiology and reported by Medicine Net²¹ revealed all participants had the Vibrio genus of bacteria on their skin after swimming in the ocean and then air drying.

Vibrio was also found to have “specific affinity for attachment to human skin,” Medicine Net reports,²² as the presence of Vibrio on the swimmers' skin was 10-fold greater than in water samples.

Iron Overload Increases Your Vulnerability to V. Vulnificus

I've mentioned iron a couple of times already, and iron may actually be a key factor in these life-threatening Vibrio infections. Not only does iron-rich water dramatically boost the growth of V. vulnificus, having excess iron in your blood may also predispose you to flesh-eating disease when exposed to the bacteria.²³ In 2015, the University of California, Los Angeles (UCLA) published an article on this important finding, noting that:²⁴

"People with a weakened immune system, chronic liver disease or iron overload disease are most at risk for severe illness. Vibrio vulnificus infections in high-risk individuals are fatal 50 percent of the time. Now, researchers at UCLA have figured out why those with iron overload disease are so vulnerable.

People with the common genetic iron overload disease called hereditary hemochromatosis have a deficiency of the iron-regulating hormone hepcidin and thus develop excess iron in their blood and tissue, providing prime growth conditions for Vibrio vulnificus.

The study²⁵ also found that minihepcidin, a medicinal form of the hormone hepcidin that lowers iron levels in blood, could cure the infection by restricting bacterial growth ... [R]esearchers compared the fatality of Vibrio vulnificus infection in healthy mice with mice that lacked hepcidin, modeling human hereditary hemochromatosis.

The results showed that the infection was much more lethal in hepcidin-deficient mice because they could not decrease iron levels in the blood in response to infection, a process mediated by hepcidin in healthy mice.

Giving minihepcidin to susceptible hepcidin-deficient mice to lower the amount of iron in the blood prevented infection if the hormone was given before the Vibrio vulnificus was introduced. Additionally, mice given minihepcidin three hours after the bacterium was introduced were cured of any infection."

The Links Between Iron Levels and Liver Health

Hemochromatosis, a hereditary disorder that causes your body to accumulate damaging levels of iron, affects 1 in 300 to 500 Caucasians.²⁶ However, you don't have to have a genetic disorder to have high iron.

In fact, most all adult men and non-menstruating women have damaging levels of iron, as the primary way to lower your iron level is through blood loss. Even women with hemochromatosis are relatively protected in their youth thanks to regular blood loss

through menses.²⁷ The primary therapy for hemochromatosis, and the easiest way to normalize your iron level if it's high, is by regularly donating blood.²⁸

Your liver is the primary organ responsible for regulating your iron level. Provided your liver is healthy, your ferritin level is likely to be healthy as well. As explained in a 2013 paper:²⁹

"Iron is an essential nutrient that is tightly regulated. A principal function of the liver is the regulation of iron homeostasis. The liver senses changes in systemic iron requirements and can regulate iron concentrations in a robust and rapid manner.

The last 10 years have led to the discovery of several regulatory mechanisms in the liver which control the production of iron regulatory genes, storage capacity, and iron mobilization. Dysregulation of these functions leads to an imbalance of iron, which is the primary causes of iron-related disorders ...

During conditions of excess iron, the liver increases iron storage and protects other tissues, namely the heart and pancreas from iron-induced cellular damage.

However, a chronic increase in liver iron stores results in excess reactive oxygen species production and liver injury. Excess liver iron is one of the major mechanisms leading to increased steatohepatitis, fibrosis, cirrhosis, and hepatocellular carcinoma."

Crucial Nutrients for Liver Health

Two nutrients crucial for liver health and function are methionine — a sulfur containing amino acid³⁰ — and choline. Research³¹ shows a methionine- and choline-deficient diet causes rapid onset and progression of the clinical pathologies associated with nonalcoholic fatty liver disease (NAFLD) in rodents, and other researchers have suggested choline may be an essential nutrient for patients with liver cirrhosis.³²

Researchers have also shown that iron overload triggers inflammation and necrosis of the liver in animals with methionine/choline-deficiency induced NAFLD.³³

According to Chris Masterjohn, who has a Ph.D. in nutritional science, choline deficiency actually appears to be a far more significant trigger of NAFLD than excess fructose and, in his view, the rise in NAFLD is largely the result of shunning liver and egg yolks.

Masterjohn explains:³⁴

"We now know that choline is necessary to produce a phospholipid called phosphatidylcholine (PC) ... a critical component of the very low density lipoprotein particle, which we need to make in order to export fats from our livers.

The amino acid methionine can act as a precursor to choline and can also be used to convert a different phospholipid called phosphatidylethanolamine directly into PC. Thus, the combined deficiency of choline and methionine will severely impair our abilities to package up the fats in our livers and to send them out into the bloodstream."

Best Sources of Choline and Methionine

A single egg can contain anywhere from 113 milligrams³⁵ (mg) to 147 mg³⁶ of choline, or about 25% of your daily requirement, making it one of the best choline sources in the American diet.³⁷ Only grass fed beef liver beats it, with 430 mg of choline per 100-gram serving.³⁸ As noted in the Fatty Liver Diet Guide:³⁹

"Eggs rank very high on the list of foods that are high in either lecithin, which converts to choline, or in choline itself. Note that this is the egg yolks only, not egg whites, which only have traces of this micronutrient.

Choline is essential in the production of phosphatidylcholine, a fat molecule called a phospholipid. But wait! Isn't all fat bad? No – especially if it is essential to overall health and in particular, liver health. Simply put – if you don't have

enough choline, your liver can't move out fat. It instead begins to collect within your liver, creating fatty liver."

This is one of the reasons I eat about six eggs a day – typically raw in my two smoothies. This gives me about 900 mg of dietary phosphatidyl choline. Other healthy choline sources include:⁴⁰

- Wild-caught Alaskan salmon⁴¹
- Krill oil – One 2011 study⁴² found 69 choline-containing phospholipids in krill oil, including 60 phosphatidylcholine substances, which helps protect against liver disease (including hepatitis and cirrhosis in alcoholics), reduce digestive tract inflammation and lessen symptoms associated with ulcerative colitis and irritable bowel syndrome
- Organic pastured chicken
- Vegetables such as broccoli, cauliflower and asparagus
- Shiitake mushrooms

As for methionine, this amino acid is found in animal protein such as fish, poultry, pork and beef. High amounts are also found in Swiss cheese and provolone.⁴³ When it comes to beef, eating “nose-to-tail,” opposed to steak exclusively, is the best way to optimize your methionine intake, as this will provide you with a healthy methionine to glycine ratio.

How to Minimize Your Risk of Flesh-Eating Disease

To try to tie this all together, here's a quick summary of the key points and take-home messages presented in this article:

- Chronic liver disease raises your risk of *V. vulnificus* infection. Optimizing your methionine and choline intake will help prevent liver disease, thus lowering your susceptibility to flesh-eating disease as well. Pastured eggs are the best source of

choline, while animal protein of all types will provide varying amounts of methionine.⁴⁴

Addressing insulin resistance – which may affect as many as 8 in 10 Americans^{45,46} – is another important strategy to protect your liver health and avoid fatty liver disease.⁴⁷

- Having a healthy liver is key for iron homeostasis in your body.
- Excess iron – which affects most men and menopausal women – significantly raises your risk of flesh-eating disease when exposed to *V. vulnificus*, either from eating raw/undercooked seafood or swimming in seawater with an open cut or scrape, allowing the bacteria entry into your body.

Normalizing your iron may thus be an important way of preventing this life-threatening infection. To do that, simply donate blood a few times a year. If your ferritin level is over 200 ng/ml, a more aggressive phlebotomy schedule is recommended.

Ideally, your serum ferritin should be somewhere between 20 and 80 ng/ml. As a general rule, somewhere between 40 and 60 ng/ml is the sweet spot for adult men and non-menstruating women.

- *V. vulnificus* is ubiquitous in seawater, and risk of infection rises along with water temperatures, as warm water spurs growth, and the bacteria adheres well to skin. To limit your risk, avoid swimming if you have open cuts or scrapes on your body, and avoid taking water into your mouth.

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