MERCOLA
Take Control of Your Health

Vitamin C Lowers Mortality in Severe Sepsis

Analysis by Dr. Joseph Mercola ✔ Fact Checked | September 06, 2022

STORY AT-A-GLANCE

- Sepsis is a last-ditch effort by your immune system to fight an infection in your body; it can lead to multiple organ failure and death unless promptly treated
- While viruses, fungi and parasites all have the ability to trigger sepsis, bacterial infections are the most common cause. The most common types of infection triggering sepsis are respiratory and urinary tract infections
- Each year, an estimated 1.7 million Americans get sepsis and nearly 270,000 die as a result. The reason for its high mortality rate is because sepsis is often overlooked; many are unfamiliar with its signs and symptoms. It's also notoriously difficult to treat
- In 2017, a critical care physician announced the discovery of a simple and inexpensive way to treat sepsis using an intravenous cocktail of vitamin C and thiamine in combination with hydrocortisone
- A 2019 study using vitamin C only found it lowered mortality risk in patients with severe sepsis, and reduced the number of days spent in intensive care and overall hospital stay

One of the leading causes of death in American hospitals is something many are still unfamiliar with: septicemia (sepsis or septic shock). Also known as blood poisoning among lay people, sepsis[1] is a last-ditch effort by your immune system to fight an infection in your body, which can lead to multiple organ failure and death unless promptly treated. As explained by the National Institute of General Medical Sciences:[2]

> *"The body releases immune chemicals into the blood to combat the infection. Those chemicals trigger widespread inflammation, which leads to blood clots and leaky blood vessels. As a result, blood flow is impaired, and that deprives organs of nutrients and oxygen and leads to organ damage.*
>
> *In severe cases, one or more organs fail. In the worst cases, blood pressure drops, the heart weakens, and the patient spirals toward septic shock. Once this happens, multiple organs — lungs, kidneys, liver — may quickly fail, and the patient can die."*

While viruses, fungi and parasites all have the ability to trigger sepsis, bacterial infections are currently the most common cause. The most common types of infection triggering sepsis are respiratory and urinary tract infections.[3] That said, research[4] has demonstrated the number of fungal-induced sepsis infections is on the rise.

The problem is that sepsis is often overlooked as many are unfamiliar with its signs and symptoms. It's also notoriously difficult to treat. A successful outcome relies on early detection and rapid treatment.

Sepsis Is the Costliest Condition Treated in the US

Each year, an estimated 1 million Americans get sepsis[5] — a dramatic increase from 1.1 million just 14 years ago in 2008[6,7] — and nearly 270,000 of them die as a result, a substantial dip from the nearly half a million that were dying every year in 2014.[8,9,10] According to data[11] from two hospital cohorts, 34.7% to 55.9% of American patients who died in hospitals between 2010 and 2012 had sepsis at the time of their death (depending on which inpatient population they were in).

Experts are now calling for recognition[12] of sepsis as a distinct cause of death, hoping this will result in better clinical practice guidelines. They also stress the importance of awareness in the community and the emergency room. To this end, September 13 has been designated as the annual "World Sepsis Day" to raise awareness.[13]

Conventional treatment, which is typically focused on high doses of antibiotics that further contribute to antibiotic resistant bacteria, is also a tremendous financial burden. A U.S. government report[14,15] published in 2016 found sepsis was the most expensive condition treated in the U.S., racking up $23.7 billion in health care costs each year; by 2022 that number had risen to $62 billion just for treatment and care.[16]

The good news is there's an inexpensive treatment that has been shown to be very effective against sepsis. The bad news is the number of hospitals that have adopted it as standard of care is still limited.

Vitamin C Concoction — An Inexpensive Cure for Sepsis

In 2017, news emerged about a critical care physician who claimed to have discovered a simple and inexpensive way to treat sepsis using an intravenous (IV) cocktail of vitamin C and thiamine (vitamin B1) in combination with the steroid hydrocortisone.[17,18]

The precise protocol used was 200 mg of thiamine every 12 hours, 1,500 mg of ascorbic acid every six hours, and 50 mg of hydrocortisone every six hours.[19]

The doctor in question, Dr. Paul Marik, former chief of pulmonary and critical care medicine at Sentara Norfolk General Hospital in East Virginia, published a small retrospective before-after clinical study[20,21,22] showing that giving septic patients this simple IV cocktail for two days reduced mortality from 40% to 8.5%.

Sentara Norfolk General Hospital, where Marik worked, has since made the protocol its standard of care for sepsis, and others are starting to join in. Unfortunately, many hospitals are still dragging their heels, waiting for more clinical trials to be completed.

This despite the fact that the treatment is harmless in and of itself, meaning it won't make the patient any worse than he or she already is. A 2018 review[23] of the available research presents a hypothetical model for why and how the Marik protocol actually works, discussing how each of the three components are known to impact the biological processes involved in sepsis.

As noted in that review,[24] reception of the treatment has been mixed, with some critical care leaders embracing it while others aren't using it at all. What this means is that your ability to receive this potentially life-saving treatment is dependent on the hospital where you end up.

On the upside, "Enthusiasm for this drug combination in sepsis has grown rapidly" since the release of Marik's initial study results, and much larger studies are now underway.

One of them was the VICTAS study[25] (Vitamin C, Thiamine and Steroids in Sepsis), sponsored by Emory University, which expected to have about 2,000 participants, but ended up with only 501.[26] The projected completion date for this study was October 2021, but it ended early for unexplained "administrative" reasons, and concluded that the treatment didn't "significantly increase ventilator- and vasopressor-free days within 30 days."

However, the authors noted that the study may not have lasted long enough to detect a "clinically important difference," so the lack of "significant" effects could be attributed to that. While I wouldn't ordinarily include a study like this in one of my articles, I think it's important to note that they didn't complete it, so the presumed lack of positive results shouldn't be used to discredit Marik's work.

What to Do if Your Doctor Refuses to Administer This

If your doctor refuses to consider Marik's protocol offhand, convince him or her to review the recent studies cited here that show this works.[27,28,29,30,31,32,33,34,35,36] Simply look up the references in the endnotes to the previous sentence (references 24 through 33) and make copies to take to your doctor.

Alternatively, you can go to PubMed[37] directly and type in "vitamin C" and "sepsis" in the search engine and you will get a list of the available research.

These articles are completely free to download. I hope you never need to access them, but if you do, you can print them and use the information to convince your medical team

to use these simple life-saving strategies. If they refuse, I would strongly suggest you take control of the situation and find another doctor and/or hospital that will.

Vitamin C Alone May Lower Mortality Risk

More recently, a study[38,39,40,41] led by Dr. Alpha "Berry" Fowler was published in the October 2019 issue of JAMA. The study is not reflective of the Marik protocol per se, as it only used IV vitamin C, but its results are still tantalizing.

Fowler and his team sought to investigate the effectiveness of vitamin C infusion on organ failure scores and biomarkers of inflammation and vascular injury in patients with severe sepsis and acute respiratory failure.

Curiously, while the vitamin C infusion had no detectable influence on these end points, those who received the treatment did have a higher chance of survival, and spent less time in the hospital. As reported by NPR:[42]

> *"If you read the study summary, vitamin C didn't help the patients. But if you dig deep into the paper, you will find that the people who got the treatment were much more likely to survive … The rub comes from the way the study … was designed."*

While vitamin C alone had no impact on organ failure scores and biomarkers of inflammation, when the researchers looked at 46 secondary endpoints, they discovered the mortality rate for the treatment group actually dropped from 46% to 30%. As noted by NPR:[43]

> *"If death had been the primary endpoint of the study, this result would have been highly significant. The conclusion would strongly support the hypothesis that vitamin C is an effective treatment of sepsis.*
>
> *But there's a catch. Since Fowler and his colleagues looked at 46 secondary endpoints, it's likely that something would randomly pop up as statistically*

> *significant. It's as though they had 46 bites at the apple to find something meaningful …*
>
> *What patients really care about, of course, is … whether they live or die. Fowler tells NPR that he now rues his decision to select an endpoint that seemed more likely to show a benefit …*
>
> *Though he's now bound by the rules of experimental design to downplay the mortality results, he personally feels a sense of success. 'We're all whooping and hollering because of what we found,' he says."*

Fowler's team also found that, on average, those who received vitamin C had by day 28 spent three fewer days in the intensive care unit than the placebo group (seven days compared to 10). By day 60, the treatment group had also spent seven fewer days in the hospital overall —15 days compared to 22.[44]

Vitamin C, Thiamine and Steroids Have Synergistic Effects

When asked for comment on Fowler's study, Marik pointed out vitamin C and corticosteroids have a synergistic effect. In other words, Fowler's study cannot really be used to judge the effectiveness of vitamin C, thiamine and steroids in combination, as it only used one of the three ingredients.

Vitamin C is well-known for its ability to prevent and treat infectious diseases on its own. Influenza,[45] encephalitis and measles[46] have all been successfully treated with high-dose vitamin C, and previous research has shown it effectively lowers proinflammatory cytokines and C-reactive protein.[47,48,49]

To investigate the mechanism of action for vitamin C in sepsis with and without steroids, Marik, in collaboration with John Catravas, Ph.D., a pharmacology researcher at Old Dominion University, and others performed a study[50] in which endothelial cells from lung tissue were exposed to **lipopolysaccharide** — a type of endotoxin found in patients with sepsis — in the absence or presence of ascorbic acid and hydrocortisone.

Interestingly, when either vitamin C or the steroid were administered in isolation, very little improvement in endothelial barrier function occurred. When administered together, however, the infection was successfully eradicated and the cells were restored to normal.

The addition of thiamine is also important. Not only is thiamine required for metabolism of some of the metabolites of vitamin C, thiamine deficiency syndrome (beriberi) has many similarities to sepsis, and thiamine deficiency is relatively common in critically ill patients.[51]

Studies have also shown thiamine can be helpful for a long list of diseases and disorders, including mitochondrial disorders,[52] heart failure,[53] delirium,[54] thyroid fatigue and Hashimoto's (a thyroid autoimmune disorder).[55] These and other health effects may help explain why thiamine works so well in conjunction with vitamin C and hydrocortisone for sepsis.

Marik told NPR that Fowler's study does highlight two important things, though. First, that there are no side effects of vitamin C infusion in critically ill patients and, second, a lowered mortality risk. "You can argue about all the statistical nuances, but that's what the study showed," Marik told NPR.[56]

Potential Contraindication

While vitamin C and thiamine administration is incredibly safe, it may be contraindicated if you happen to be glucose-6-phosphate dehydrogenase (G6PD) deficient, which is a genetic disorder.[57] G6PD is an enzyme your red blood cells need to maintain membrane integrity.

High-dose IV vitamin C is a strong prooxidant, and giving a prooxidant to a G6PD-deficient individual can cause their red blood cells to rupture, which could have disastrous consequences.

Fortunately, G6PC deficiency is relatively uncommon, and can be tested for. People of Mediterranean and African descent are at greater risk of being G6PC deficient.

Worldwide, G6PD deficiency is thought to affect 400 million individuals, and in the U.S. an estimated 1 in 10 African-American males have it.[58]

Know the Signs and Symptoms of Sepsis

One of the most important steps you can take to protect your health is to recognize the symptoms of sepsis and seek immediate medical attention if you suspect it.

It is important not to make a diagnosis at home. Instead communicate your concerns with a medical professional so that proper testing and treatment can be implemented. Common signs and symptoms of sepsis include the following.[59,60,61] Many of these symptoms may be confused with a bad cold or the flu. However, they tend to develop much more rapidly than you would normally expect.

A high fever with chills and shivering	Rapid heartbeat (tachycardia)
Rapid breathing (tachypnea)	Unusual level of sweating (diaphoresis)
Dizziness	Confusion or disorientation
Slurred speech	Diarrhea
Difficulty breathing, shortness of breath	Severe muscle pain
Low urine output	Cold and clammy skin
Skin rash	Nausea and/or vomiting

The Sepsis Alliance recommends using the acronym TIME to remember some of the more common symptoms:[62]

- T — Temperature higher or lower than normal?
- I — Have you now or recently had any signs of an infection?

- M — Are there any changes in mental status, such as confusion or excessive sleepiness?
- E — Are you experiencing any extreme pain or illness; do you have a "feeling you may die?"

Post-Sepsis Syndrome

While some will recover fully from sepsis, for many the problems do not end at discharge from the hospital. Survivors may suffer physical, psychological and/or neurological consequences for the rest of their lives. For some survivors, their immune function can remain depressed for as long as a year after their recovery, resulting in frequently recurring infections.

The combination of symptoms is called post-sepsis syndrome and usually last between six and 18 months. Symptoms of post sepsis syndrome may include:[63,64]

Lethargy (excessive tiredness)	Changes in peripheral sensation	Repeated infections at the original site or a new infection
Poor mobility	Muscle weakness	Shortness of breath
Chest pains	Swollen limbs	Joint and muscle pains
Depression, mood swings, anxiety or sadness	Hair loss	Dry flaking skin and nails
Taste changes	Poor appetite	Changes in vision
Difficulty swallowing	Reduced kidney function	Feeling cold
Excessive sweating	Post-traumatic stress disorder	Flashbacks and nightmares

Poor concentration and clouded thinking	Insomnia	Short-term memory loss

There is no specific treatment for post-sepsis syndrome, but most get better over time. The U.K. Sepsis Trust[65] recommends managing individual symptoms and supporting optimal health as you're recovering.

Not all medical professionals are aware of post-sepsis syndrome, so it may be helpful to talk about your symptoms and ask for a referral to someone who may help manage your mental, physical and emotional challenges.

How to Reduce Your Risk of Sepsis

Again, part of what makes sepsis so deadly is people typically do not suspect it, and the longer you wait to treat it, the deadlier it gets.[66] If you develop an infection, stay alert to symptoms of sepsis and seek immediate medical attention if they appear. Even health care workers can miss the signs and delay treatment.

While health care workers have a responsibility to prevent infections that could potentially turn septic and to educate patients about warning signs of sepsis, you can lower your own risk by:

- **Promptly treating urinary tract infections (UTIs) —** UTIs are the second most common type of infection,[67] and one-quarter of sepsis cases are related to UTIs.[68]

  Conventional treatment typically involves antibiotics, but research[69,70] shows that UTIs caused by E. coli — which comprise[71] 90% of all UTIs — can be successfully treated with D-Mannose, a naturally occurring sugar that's closely related to glucose.

- **Properly cleaning skin wounds —** About 1 in 10 sepsis cases are due to skin infections, so always take the time to properly clean and care for wounds and scrapes. Wash the wound with mild soap and water to clean out dirt and debris,

then cover with a sterile bandage. Diabetics should follow good foot care to avoid dangerous foot infections.

- **Caring for any chronic illness affecting your risk of sepsis —** Research has found illnesses that increase your risk may include chronic lung disease, chronic kidney disease, diabetes, stroke and cardiovascular disease.[72]

- **Avoiding nail biting —** One study found 46.9% of the participants were nail biters.[73] Exposure of the delicate skin underneath the nail, transferred from your mouth or acquired from the environment, increases your risk of infection.

- **Avoiding infections in hospitals —** When visiting a health care facility, be sure to wash your own hands, and remind doctors and nurses to wash theirs (and/or change gloves) before touching you or any equipment being used on you.

  If you have to undergo a colonoscopy or other testing using a flexible medical scope, remember to call and ask how they clean their scopes and what kind of cleaning solution they use.

  If the answer is glutaraldehyde (brand name Cidex), find another hospital or clinic — one that uses peracetic acid. This preliminary legwork will significantly decrease your risk of contracting an infection from a contaminated scope.

Sources and References

- [1] Centers for Disease Control and Prevention, What is Sepsis?
- [2, 59] National Institute of General Medical Sciences, Sepsis
- [3, 64] World Sepsis Day, Sepsis
- [4] Expert Review of Anti-Infective Therapy 2012; 10(6):701
- [5] NIH. Sepsis
- [6] CDC Inpatient Care for Septicemia or Sepsis
- [7] Mayo Clinic, Sepsis
- [8] PharmacoEconomics. 2004;22(14):895-906
- [9] NIH.gov Sepsis Fact Sheet
- [10] Advisory Board, May 21, 2014
- [11] JAMA, 2014; 312(1):90
- [12, 60] World Sepsis Day, Sepsis FAQ

- [13] World Sepsis Day
- [14] HCUP Statistical Brief #204, May 2016, Table 1
- [15] Sepsis Alliance News, July 30, 2016
- [16] Persown. The Economic Burden of Sepsis
- [17] NPR March 23, 2017
- [18] NBC4i.com March 23, 2017
- [19, 20] Chest June 2017; 151(6): 1229-1238
- [21] Dr. Malcolm Kendrick, January 28, 2017
- [22] Science Daily June 26, 2017
- [23] Critical Care 2018; 22: 283
- [24] Critical Care 2018; 22: 283, Ascorbic acid, corticosteroids and thiamine for the treatment of sepsis in current practice
- [25] Clinical Trials VICTAS, Clinical trial identifier: NCT03509350
- [26] JAMA. February 23, 2021
- [27] J Clin Med. 2019 Apr 9;8(4). pii: E478
- [28] Ann Intensive Care. 2019 May 20;9(1):58
- [29] J Thorac Dis. 2019 Apr;11(4):1562-1570
- [30] Trials. 2019 Jul 11;20(1):420
- [31] Crit Care. 2019 Jul 30;23(1):265
- [32] Nutrients. 2019 Aug 23;11(9). pii: E1994
- [33] Journal of Clinical Medicine January 16, 2019' 8(1): E102
- [34] Indian Journal of Anaesthesia December 2018; 62(12): 934-939
- [35] Nutrients November 14, 2018; 10(11): E1762
- [36] Critical Care October 29, 2018; 22(1): 283
- [37] Pubmed
- [38] JAMA October 1, 2019;322(13):1261-1270
- [39, 44] Health Canal October 1, 2019
- [40] Science Daily October 1, 2019
- [41] Medical Xpress October 1, 2019
- [42, 43, 56] NPR October 1, 2019
- [45] Journal of Manipulative and Physiological Therapeutics 1999 Oct;22(8):530-3
- [46] Clinical Guide to the Use of Vitamin C by Fredrick R. Klenner, MD
- [47] Journal of Translational Medicine 2012; 10: 189
- [48] Riordan Clinic Press Release October 2012
- [49] Naturalhealth365.com November 22, 2016
- [50] Chest 2017 Nov; 152(5): 954–962
- [51] Critical Care 2018; 22: 283, Thiamine
- [52] Mayo Clinic, Thiamine
- [53] Heart Failure July 2013, DOI: 10.1111/chf.12037
- [54] Innovations in Clinical Neuroscience 2013 Apr; 10(4): 26–32
- [55] Thyroidpharmacist.com February 3, 2015

- [57, 58] NIH.gov Glucose-6-Phosphate Dehydrogenase Deficiency
- [61] Medical News Today, October 23, 2018
- [62] Sepsis Alliance, December 14, 2018
- [63, 65] Sepsis Trust, Post Sepsis Syndrome
- [66] Consumer Reports, August 23, 2016
- [67] Medline Plus UTI's
- [68] Journal of Global Infectious Diseases 2009 Jan-Jun; 1(1): 57–63
- [69] Urology Research 1983;11(2):97-102
- [70] Kresser Institute September 22, 2016
- [71] Transl Androl Urol 2017 Jul; 6(Suppl 2): S142–S152.
- [72] Plos|One, 2012;7(10)
- [73] Acta Derm Venereol 2014; 94: 67–71