



# Vitamin C — A Game Changer in Treatment of Deadly Sepsis

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## Story at-a-glance

- ▶ Each year, an estimated 1 million Americans get sepsis and up to half die. Giving patients IV vitamin C with hydrocortisone and thiamine reduced mortality nearly fivefold, from 40 percent to 8.5 percent
- ▶ A leading sepsis researcher is now planning a multicenter trial to put this novel vitamin C treatment to the test across the nation
- ▶ Research shows IV vitamin C following a course of antibiotics **effectively kills cancer stem cells** responsible for metastasis of lethal

## By Dr. Mercola

Each year, an estimated 1 million Americans get sepsis<sup>1,2</sup> and up to half of them die as a result.<sup>3,4,5</sup> Sepsis is a progressive disease process initiated by an aggressive, dysfunctional immune response to an infection in the bloodstream, which is why it's sometimes referred to as blood poisoning.

While **illnesses such as bronchitis, pneumonia, strep throat, kidney infection or even localized infections can turn septic, sepsis is most commonly acquired in hospital settings.**<sup>6,7</sup> Starting out with symptoms of infection, the condition can progress to septic shock, which may be lethal. Unless treated, sepsis can result in extremely low blood pressure that is unresponsive to fluid replacement, weakening of the heart and multiple-organ failure.

Unfortunately, treatment can be a considerable challenge, and is becoming even more so as drug-resistant infections become more prevalent. According to the Agency for Healthcare Research and Quality, sepsis is the most expensive condition being treated in U.S. hospitals, costing more than \$24 billion in 2014.<sup>8</sup>

## Critical Care Doctor Discovers Inexpensive Cure for Sepsis

Earlier this year, news emerged about a critical care physician who claimed to have discovered a simple and inexpensive way to treat sepsis using intravenous (IV) vitamin C, thiamine (vitamin B-1) in combination with the steroid hydrocortisone<sup>9,10</sup> — a discovery that may save tens of thousands of lives and billions of dollars each year.

Dr. Paul Marik, chief of pulmonary and critical care medicine at Sentara Norfolk General Hospital in East Virginia, published a small retrospective before-after clinical study<sup>11,12,13</sup> showing that giving septic patients this simple IV cocktail for two days reduced mortality nearly fivefold, from 40 percent to 8.5 percent. Of the 50 patients treated, only four died, but none of them actually died from sepsis; they died from their underlying disease.

In all, Marik has treated more than 150 septic patients with this protocol so far, and only one has died from sepsis. In the featured video above, Marik discusses his study and the vitamin C protocol.

More than 50 medical centers around the U.S. have also started implementing the protocol, with similarly spectacular results. This should be cause for celebration but, as usual, there are detractors and skeptics saying Marik's study is little more than fodder for hyperbole.<sup>14</sup> Many doctors are also wary of using such a novel treatment.<sup>15</sup>

As noted by Smithsonian: "For many doctors, Marik's protocol represents a dilemma. There seem to be no ill effects. Yet, there are also no randomized clinical trials. Should they embrace an untested treatment?"<sup>16</sup> It's an ironic question, if you consider many conventional medical treatments are still experimental at best. Flawed trials often promise more than can be delivered, and it can sometimes take years or even decades before the mistake is rectified.

In this case, the chances of doing more harm than good are extremely low, so what is there to lose? Sentara Norfolk General Hospital, where Marik works, has already made the protocol its standard of care for sepsis. The hospital president is considering making it standard of care in its other 12 hospitals as well.

*"Marik and others enthusiastic about the treatment agree with skeptics who say blind, randomized clinical trials need to be done to validate the treatment's efficacy. However, they also say that the dramatic results so far mean doctors should embrace the treatment in the meantime — an unorthodox proposition, to say the least,"* Smithsonian writes.<sup>17</sup>

*"During an interview in his office, Marik called up Dr. Joseph Varon, a pulmonologist and researcher at the University of Texas Health Science Center in Houston. 'It does sound too good to be true,' Varon said over the phone. 'But my mortality rates have changed dramatically. It is unreal. Everything we have tried in the past didn't work. This works.'"*

## How Does the Treatment Work?

Vitamin C is well-known for its ability to prevent and treat infectious diseases. Previous research has shown it effectively lowers proinflammatory cytokines and C-reactive protein.<sup>18,19,20</sup> Influenza,<sup>21</sup> encephalitis and measles<sup>22</sup> have all been successfully treated with high-dose vitamin C.

To investigate the mechanism of action for sepsis, Marik reached out to John Catravas, Ph.D., a pharmacology researcher at Old Dominion University. At Marik's request, Catravas performed an independent lab study, which confirmed the effectiveness of the treatment. Catravas cultured endothelial cells from lung tissue and then exposed them to endotoxins found in patients with sepsis.

Interestingly, vitamin C acts like the steroid hydrocortisone, yet when either vitamin C or the steroid were administered in isolation, nothing happened. 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, research has also shown many patients with sepsis are vitamin deficient, and when thiamine is given, it reduces the risk of renal failure and mortality.

Studies have also shown thiamine can be helpful for a long list of diseases and disorders, including mitochondrial disorders,<sup>23</sup> heart failure,<sup>24</sup> delirium,<sup>25</sup> thyroid fatigue and Hashimoto's (a thyroid autoimmune disorder).<sup>26</sup> These and other health effects may help explain why thiamine works so well in conjunction with vitamin C and hydrocortisone for sepsis. In short, the key Marik intuitively stumbled upon was the right combination of ingredients.

## Nationwide Trial Underway

Dr. Craig Coopersmith, a leading sepsis researcher at Emory University School of Medicine, is now planning a multicenter trial to put Marik's vitamin C protocol to the test across the nation. "If this is validated, this would be the single biggest breakthrough in sepsis care in my lifetime," he told Smithsonian.<sup>27</sup>

Results from his field trial cannot come soon enough, as current best practices are ineffective at best. For example, recent research shows the standard calling for rapid and substantial infusion of IV fluids have no effect on survival rates,<sup>28</sup> and previous guidelines calling for the use of a specific drug turned out to do more harm than good.<sup>29</sup> In short, there are few good alternatives available, making Marik's treatment protocol all the more crucial.

Sepsis kills more than breast cancer, colon cancer and AIDS combined, and here's a treatment that is not only profoundly effective, but also has no side effects, is inexpensive, readily available and simple to administer. Patients and doctors really have nothing to lose by trying it, but to make it standard of care across the U.S., more evidence is needed.

## 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.<sup>30</sup> 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.<sup>31</sup>

## Vitamin C and Antibiotics — A Winning Combo Against Cancer Stem Cells

Studies have also shown vitamin C can be used as an adjunct to [cancer therapy](#). Vitamin C is selectively cytotoxic to cancer cells by generating hydrogen peroxide when administered intravenously in high doses, and recent [research suggests vitamin C in combination with antibiotics helps kill cancer stem cells — cancer cells responsible for metastasis of lethal tumors](#).

Here, researchers at the University of Salford in the U.K. used the antibiotic Doxycycline, followed by IV vitamin C and, again, it's all about the combination. It's well-known that that cancer cells can survive chemotherapy and develop resistance to the drug. The study in question was designed to determine how this occurs.

They suspected the answer could be found in metabolically flexible cancer cells — in other words, cells capable of switching from one fuel source to another. Science Daily reports:<sup>32</sup>

*"The researchers say their method offers a new explanation for how to prevent cancer cells from becoming treatment-resistant and how combinations therapies can be developed to overcome drug resistance. Professor Michael Lisanti, who designed the study, explained ... 'Thus, when the drug treatment reduces the availability of a particular nutrient, the flexible cancer cells can feed themselves with an alternative energy source.'*

*This new combination approach prevents cancer cells from changing their diet (metabolically inflexible), and effectively starves them, by preventing them from using any other available types of biofuels.*

*The team ... added Doxycycline in ever increasing doses over a three-month period, to induce metabolic inflexibility. The result was to leave the cancer cells ... severely attenuated and depleted, so that they would be much more susceptible to starvation, by a second metabolic "punch."*

*First, the researchers inhibited the tumor cell mitochondria, by restricting the cancer cells only to glucose as a fuel source; then, they took away their glucose, effectively starving the cancer cells to death. 'In this scenario, vitamin C behaves as an inhibitor of glycolysis, which fuels energy production in mitochondria, the 'powerhouse' of the cell,' explained co-author Dr. Federica Sotgia."*

## **Vitamin C Is an Excellent Emergency Kit Staple**

Vitamin C by itself outperformed 2-Deoxy-D-glucose (2-DG, a glycolytic inhibitor<sup>33</sup>) by as much as 10 times when it came to preventing cancer cell growth. When combined with an antibiotic, the treatment is nearly 100 times more effective. Best of all, while antibiotics do have health risks (since they decimate your gut microbiome), antibiotics and vitamin C are far safer than most cancer drugs, dramatically reducing a patient's risk of adverse treatment effects.

The team also identified eight additional products that can be used in lieu of vitamin C, including [berberine](#) — a natural plant compound shown to work as well as metformin for diabetes. As noted by Lisanti, "This is **further evidence that vitamin C and other nontoxic compounds may have a role to play in the fight against cancer.**"

Indeed, while I do not recommend taking high doses of vitamin C on a daily basis, I'm absolutely convinced it is a key staple that belongs in everyone's home emergency kit. In cases of acute illness, I recommend taking 2 to 3 grams of vitamin C per HOUR until you

feel better. Note that **most people will get loose stools with conventional oral vitamin C, which is why the vitamin C should be liposomal. This prevents the loose stools and provides blood levels similar to IV vitamin C without the expense or inconvenience.**

In my experience, this high dose liposomal C every hour will typically reverse acute illnesses within 24 hours or so. Just make sure it is liposomal vitamin C. I always travel with a bottle of this and regularly give it away to clinicians I see who have come down with an acute infection.

For general health, it's fairly easy to get sufficient amounts of vitamin C from food, so supplements are usually not necessary. I grow acerola cherries, which are particularly high in vitamin C. Each cherry provides about 80 mg of vitamin C. I will sometimes eat up to 100 cherries a day, giving me about 8 grams of vitamin C — far above the recommended daily intake of 90 mg/day.

Still, if I were to become ill, I would not hesitate to take high doses of vitamin C, including the use of IV vitamin C if the situation were sufficiently dire — although I would start with hourly high dose liposomal C as I think it would work just as well, and only progress to IV if the high dose liposomal C was not working. In the case of sepsis, I think using IV vitamin C with thiamine and hydrocortisone makes a world of sense, especially since the risks are virtually nonexistent.

## **Common Sense Strategies to Reduce Your Risk of Sepsis**

With sepsis affecting more than a million Americans each year, it's important to be aware of its signs, symptoms and risks. Part of what makes it so deadly is that people typically do not suspect it, and the longer you wait to treat it, the deadlier it gets.<sup>34</sup> Even health care workers can miss the signs and delay treatment. According to the Centers for Disease Control and Prevention (CDC), you're at higher risk for sepsis if you have:

- **Chronic disease.** A vast majority — 7 out of 10 — of people who develop sepsis have some kind of chronic health condition. Those with diabetes, lung, kidney or liver disease tend to be particularly susceptible to infection, which raises the risk.
- **Weakened immune system,** AIDS or cancer.
- **Recently spent time in a hospital, nursing home or other health care facility,** as exposure to infection-causing bacteria is common in these places.

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 in the body, sending more than 8 million people to their health care providers every year in the U.S. alone,<sup>35</sup> and one-quarter of sepsis cases are related to urinary tract infections.

Conventional treatment typically involves antibiotics, but research shows 90 percent of UTIs can be successfully treated with D-Mannose, a naturally occurring sugar that's closely related to glucose. To learn more, see "[D-Mannose for UTI Prevention Validated in a Clinical Trial.](#)"

- **Properly clean 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.
- **Avoid 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.