Intravenous Ascorbic Acid (IVAA) for COVID-19

Supportive Treatment in Hospitalized COVID-19 Patients

(Based on use in China and US settings)

Primary Author: Dr. Paul S. Anderson

EXECUTIVE SUMMARY

*This summary is based on data (attached) not released in full outside China as of 03-23-2020

IVAA is a safe medical intervention

IVAA has been shown to shorten hospital / ICU stays

IVAA is an inexpensive additional intervention in COVID-19 hospitalized patients

IVAA is simple to compound for the pharmacy and easy to administer by nursing staff

IVAA has been used successfully in the management of "cytokine storms"

Abstract:

Intravenous ascorbic acid (IVAA) is a well-known intervention in medicine, which currently is rarely used in US hospitals. Due to the unusual and extreme clinical demands of hospitalized COVID-19 patients, IVAA has been implemented in Chinese hospitals, and data published by the "Expert Group on Clinical Treatment of New Coronary Virus Disease in Shanghai" (direct translation) details the use of IVAA as safe and effective adjunctive care of hospitalized COVID-19 patients. In the IVAA treated group, there was no mortality, no reported side effects, and shorter hospital stays universally. In addition, the Shanghai Expert Group recommends IVAA use in extremely critical settings within COVID-19 patients. IVAA, as an intervention, is relatively inexpensive and simple for both pharmacy and nursing staff use. The primary author has also used IVAA in the US under a NIH funded human trial and has extensive subject matter knowledge and expertise.

Salient Clinical Data:

IVAA is an FDA approved drug that is used in many settings, but until recently, has been poorly studied in US hospital systems. It is, however, commonly used in many other countries as an adjunctive therapy for multiple conditions. The crisis in China, and the presence of an expert in the use of IVAA in the

Shanghai Expert Group, facilitated the addition of IVAA to their therapeutic interventions in the hospital treatment of patients with COVID-19. Background data and details are in the references, resources, and information below, but the points critical to use in this current crisis are:

- Chinese facility patient load: 358 total Covid-19 patients as of March 17th, 2020.
- Facility treated approximately 50 cases (of the 358) of moderate to severe COVID-19 infection with IVAA.
- The IVAA dosing was moderate and affordable (detail below) and dose determined by clinical status.
- All patients who received IVAA improved.
- There was no mortality in the IVAA group.
- There were no side effects reported from any patients in the IVAA group.
- Average COVID-19 patients had a 30-day hospital stay, but COVID-19 patients that received IVAA had a hospital stay that was 3 to 5 days shorter than the non IVAA treated patients.
- The author of this summary is available as a subject matter expert if needed and can also facilitate connection with other subject matter experts on IVAA as needed.

Hospital Application:

The use of IVAA was in conjunction with all typical hospital / ICU therapies. For detailed data, the author has attached a two documents to this summary, which is the Consensus Document on COVID-19 from the China Journal of Infectious Diseases, 2020. The attachment is a direct English translation the author produced as the source document is in Mandarin Chinese, which is also attached.

Regarding dosing there are three similar reported dosing strategies. The author has edited these to the most efficacious and simple to implement dose strategy based on his clinical and research experience.

The doses used above for IVAA as adjunctive care were 100 mg / kg per day (continuous infusion) for hospitalized COVID-19 patients and 200 mg / kg per day (continuous infusion) for the control of "cytokine storm" presentations. Pharmacy and nursing detail regarding these doses are noted below.

Use and Safety of IVAA in the US:

IVAA has been used in trials in the United States, and some of those will be reflected in the references below. The author's personal use spans over two decades in clinical practice as well as specific use in a NIH funded human trial. In this trial, IVAA was used at various doses in the adjunctive care of patients

with advanced cancers. As with the reports from the Shanghai Expert Panel, the author also experienced IVAA as safe, cost effective, and well tolerated intervention in even the most critical patients.

Conclusion:

The inclusion of IVAA in the adjunctive care of hospitalized COVID-19 patients in the US is reasonable and supported by direct experience with COVID-19. IVAA is safe, cost effective, and easy to implement for hospital pharmacy and nursing staff. In the Chinese Expert Panel's experience, it also shortened hospital stays by 3 to 5 days over those not receiving IVAA, which would not only be a cost saving, but also free up needed hospital resources during this pandemic.

Supplementary Resources:

Attachments:

Expert Group on Clinical Treatment of New Coronary Virus Disease in Shanghai. China Journal of Infectious Diseases, 2020,38: Online Prepublish. DOI: 10.3760/cma.j.issn.1000-6680.2020.0016 [English Translation, and original]

Pharmacy and Nursing Detail:

- Dose: 100 mg / kg given over 24 hours in a continuous infusion for general use. A dose of 200 mg / kg for use in "cytokine storm" response.
- Admixture: 50% of the total body weight dose admixed in 500 mL of 0.9% saline. For a 70 kg patient this is an addition of 14 mL (of the standard 500 mg / mL Ascorbic Acid for infusion) to the 500 mL saline bag.
- Administration: The 50% dose in 500 mL 0.9% saline is infused every 12 hours. On a continuous basis.

Approximate Drug Cost:

For a 70 kg patient the 100 mg / kg dose would cost approximately $ 12.00 per 24 hours (exclusive of the saline carrier and other consumables cost). The 200 mg / kg dose would be approximately $ 24.00 per 24 hours.

References:

1. Shanghai 2019 comprehensive treatment of coronavirus disease expert consensus: Expert Group on Clinical Treatment of New Coronary Virus Disease in Shanghai. China Journal of Infectious Diseases, 2020,38: Online Prepublish. DOI: 10.3760/cma.j.issn.1000-6680.2020.0016

2. Integrative Oncology Outcomes Study in Breast Cancer (IO-OS-BC) ClinicalTrials.gov Identifier: NCT01366248

3. Padayatty SJ, Sun AY, Chen Q, Espey MG, Drisko J, Levine M. Vitamin C: intravenous use by complementary and alternative medicine practitioners and adverse effects. PLoS One. 2010;5(7):e11414. Published 2010 Jul 7. doi:10.1371/journal.pone.0011414

4. Mikirova N, Casciari J, Rogers A, Taylor P. Effect of high-dose intravenous vitamin C on inflammation in cancer patients. J Transl Med. 2012;10:189. Published 2012 Sep 11. doi:10.1186/1479-5876-10-189

5. Mikirova N, Casciari J, Riordan N, Hunninghake R. Clinical experience with intravenous administration of ascorbic acid: achievable levels in blood for different states of inflammation and disease in cancer patients. J Transl Med. 2013;11:191. Published 2013 Aug 15. doi:10.1186/1479-5876-11-191

6. Hoffer LJ, Robitaille L, Zakarian R, et al. High-dose intravenous vitamin C combined with cytotoxic chemotherapy in patients with advanced cancer: a phase I-II clinical trial. PLoS One. 2015;10(4):e0120228. Published 2015 Apr

7. doi:10.1371/journal.pone.0120228 7. Duconge J, Miranda-Massari JR, Gonzalez MJ, Jackson JA, Warnock W, Riordan NH. Pharmacokinetics of vitamin C: insights into the oral and intravenous administration of ascorbate. P R Health Sci J. 2008 Mar;27(1):7-19. PMID: 18450228

8. Ried K, Travica N, Sali A. The acute effect of high-dose intravenous vitamin C and other nutrients on blood pressure: a cohort study. Blood Press Monit. 2016;21(3):160–167. doi:10.1097/MBP.0000000000000178

Quotes from the interview with Dr. Mao:

Interview excerpts by Richard Cheng, MD, PhD of his interview with Dr. Engian Mao:

Dr. Enqian Mao, chief of emergency medicine department at Ruijin Hospital, a major hospital in Shanghai, affiliated with the Joatong University College of Medicine. He is a member of the Senior Expert Team at the Shanghai Public Health Center and a co-author of the Shanghhai Guidelines for the Treatment of Covid-19 Infection, an official document endorsed by the Shanghai Medical Association and the Shanghai city government.

“Dr. Mao has been using high-dose dose IVC to treat patients with acute pancreatitis, sepsis, surgical wound healing and other medical conditions for over 10 years. When Covid-19 broke out, he and other experts thought of vitamin C and recommended IVC for the treatment of moderate to severe cases of Covid-19 patients. The recommendation was accepted early in the epidemic by the Shanghai Expert Team.” [Interview quoted from Dr. Cheng, Orthomolecular Medicine News Service, Mar 18, 2020]