What Really Caused the Death of General Edward Hand?

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Thesis:

The Edward Hand Medical Heritage Foundation has decided to address the death of General Edward Hand and what caused it. In multiple sources and history records, General Hand's death is recorded as cholera. After conducting a literature search and reviewing the newspaper accounts and reports of cholera epidemics in the world during that time, it seems unlikely that General Edward Hand died from epidemic cholera, but it is more plausible that he succumbed to a type of non-epidemic cholera or gastrointestinal infection. This is indicated in his obituary as cholera morbus, that is, a cholera-like illness resulting in a bloody diarrhea illness, perhaps aggravated by the toxic effects of a medicinal.

Methodology:

When I first started my research on the death of General Edward Hand, I had to make sure I took diligent notes from reliable sources, which were difficult to find. I made a trip to the Mutter Museum in Philadelphia to look for any record of a cholera outbreak during the year of 1802 and then any outbreaks of other diseases during that same time. I did not come across significant information about any epidemics, let alone an outbreak of cholera. Not sure where to go from there, I thought the best place to start my new search would be LancasterHistory.org, where I looked through two local newspapers for the whole year of 1802 to see if there was any news of an epidemic or something similar. In the week of September 8th, I found General Edward Hand's obituary which listed his cause of death as Cholera morbus.

Cholera morbus was a diagnosis that covered many different gastrointestinal infectious illnesses. I contacted Rock Ford Plantation to see who else was living at the plantation during the time of his death. General Hand's family and staff were all living there during that time with no record of them falling ill or dying the same way that General Hand did, which lead me to the belief that General Hand's death had to have been caused by something that was not of epidemic nature.

I then compared the symptoms of cholera to the symptoms of the various diseases that are covered under the general heading of cholera morbus. I found that they are all very similar, with the key difference being the epidemic nature of cholera. Cholera morbus illnesses usually do not result from an epidemic.

Since death records were not kept in Lancaster County in 1802, I also checked the cemetery where General Edward Hand was buried as well as other area cemeteries to see if there was a spike in deaths that occurred during the surrounding months that would have indicated an outbreak of some kind of epidemic disease. I found no indication of an increase in deaths in the months surrounding Hand's death.

I was able to make a solid assumption that the diagnosis of General Edward Hand's death in his obituary was correct. However, over time historians and biographers had simply stated that he succumbed to cholera, therefore leading readers to believe that he died in a cholera epidemic in 1802. It is interesting to see how the slightest change in the name of a diagnosis, such as the omission of one word, could alter what the reader and history perceive as accurate.

What Really Caused the Death of General Edward Hand?

Not appearing in Europe and North America until around 1831, cholera epidemics were assumed to have originated in India. Improper heath precautions in an age of increasing industrialization and urban transformations may have been a catalyst for the epidemics that sprang up in the United States of America during the 19th century.[1] General Edward Hand, an Irish native and adjutant general in the Continental Army under General George Washington, was thought to have died of cholera on September 3nd, 1802.[2] The Edward Hand Medical Heritage Foundation has endeavored to research his death and the assumed cholera epidemic that would have caused his death 1802.

Cholera, as we know it in modern day, is caused by a bacterium Vibrio cholerae that enters the body through contaminated food and/or drink. The food or drink can be contaminated by fecal matter or from generally poor environmental cleanliness.[3] The organism passes through the stomach to colonize in the small intestine. After passage through the stomach, the number of microorganisms is reduced drastically because of the effect of stomach acid, still leaving virulent doses. The microorganisms adhere to the intestinal mucous membrane of the small intestine and prepare to reproduce. However, the microorganism does not penetrate the membrane itself; rather it latches onto the villi in order to secrete a toxin called choleragen. This particular toxin will disrupt the basic cell physiology by attaching to intestinal receptors.[4]

Once a subunit enters the cell, adenylate cyclase is activated.[5] Adenylate cyclase turns ATP into cyclic adenine monophosphate (AMP).[6] This increases chloride secretions and impairs the absorption of sodium by the finger-like projections that specialize in absorption on the intestine wall called villi.[7] This impairment allows larger amounts of sodium and chloride be released into the intestine. This leads to water loss, dehydration, decrease in blood volume, acidosis, muscle cramps and in some cases coma and convulsions. In modern day, the most effective way to treat cholera is through oral and intravenous rehydration therapy, including sugar-salt solutions and sodium taken by mouth and intravenously respectively.[8]

In the Lancaster New Era during the week of September 8, 1802, General Edward Hand's obituary appeared and read:

> *"Died, after a few hours of sickness of cholera morbus on the 4th Inst. At his Seat on the Conestoga, in the vicinity of this Borough, Gen. Edward Hand, in the 58th year of his age, and his remains were interred the following day in the Episcopal Burial-ground in the Borough of Lancaster, attended by his weeping relatives, and a crowd of sympathizing Friends."*

The term used to describe General Hand's death was "cholera morbus".[9] After researching Cholera morbus more specifically, it was clear that it is not the same as the cholera that we know today. Cholera morbus is a term that was used for non-epidemic cholera during the 18th and 19th centuries and the term is no longer in clinical use. Non-epidemic choleras are very similar to epidemic cholera in their transmission.[10] There are a variety of infections that mimic cholera that are considered to be non-epidemic. These varieties include viral gastroenteritis, typhoid, dysentery, Salmonella, E. coli, as well as others. The symptoms in epidemic and non-epidemic infections are all similar in that they include diarrhea, vomiting, cramps, occasional fever, and, most importantly, dehydration.[11] If the dehydration is not treated adequately, it could lead to death.[12] The comparison of epidemic cholera and different varieties of non-epidemic cholera are demonstrated in the following chart (Figure 1).

As seen in Figure 1, there are many similarities in the epidemic cholera that we associate with decimating populations and the Cholera morbus, or non-epidemic cholera, that General Edward Hand was said to have died of. In researching cholera epidemics in the 19th century and when cholera would have reached Lancaster County, information was found on the first cholera epidemic in Pennsylvania occurring in 1832, but a cholera epidemic did not reach Lancaster until 1854.[13]

Figure 1: Comparisons of Epidemic and Non-epidemic Choleras

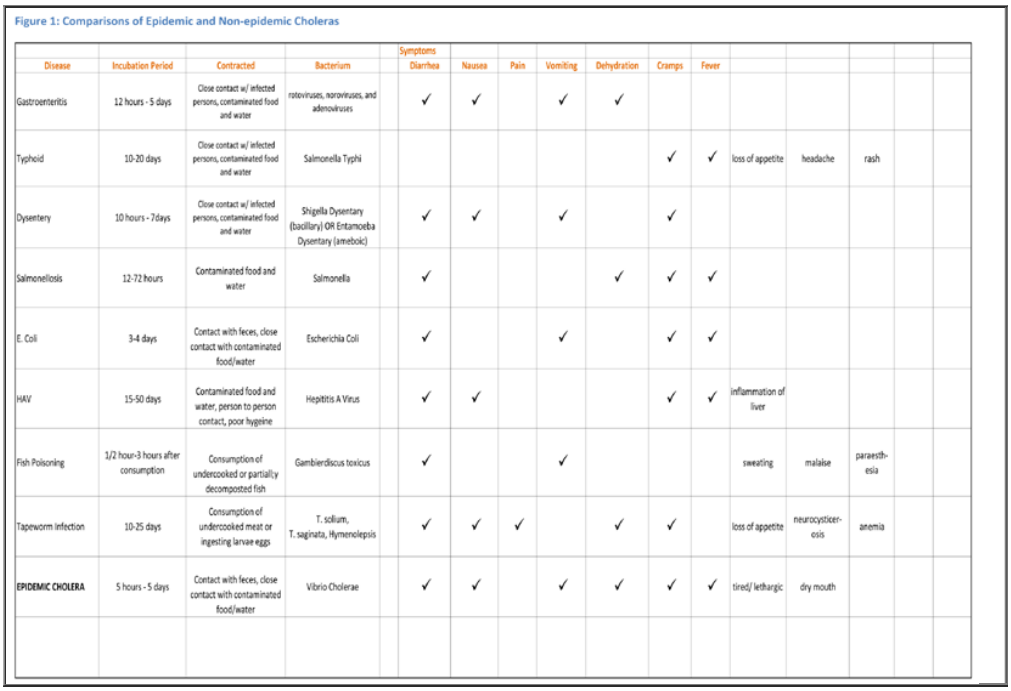


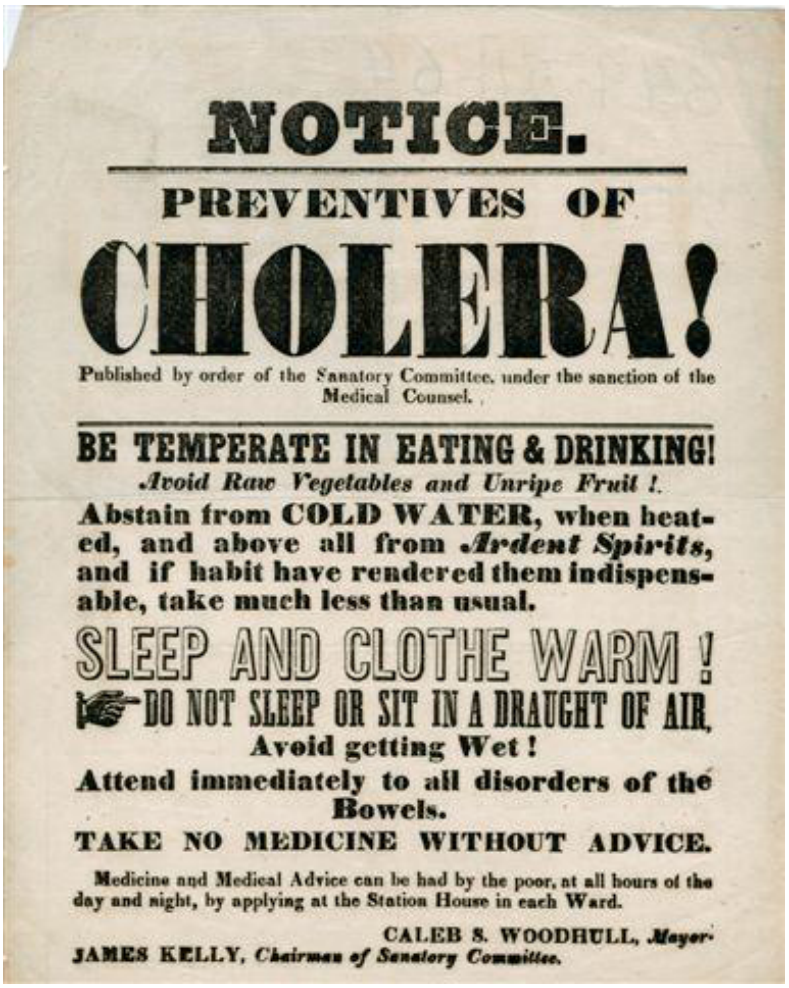
Figure 1: Comparisons of Epidemic and Non-epidemic Choleras

				Symptoms										
Disease	Incubation Period	Contracted	Bacterium	Diarrhea	Nausea	Pain	Vomiting	Dehydration	Cramps	Fever				
Gastroenteritis	12 hours - 5 days	Close contact w/ infected persons, contaminated food and water	rotoviruses, noroviruses, and adenoviruses	✓	✓		✓	✓						
Typhoid	10-20 days	Close contact w/ infected persons, contaminated food and water	Salmonella Typhi						✓	✓	loss of appetite	headache	rash	
Dysentery	10 hours - 7days	Close contact w/ infected persons, contaminated food and water	Shigella Dysentary (bacillary) OR Entamoeba Dysentary (ameboic)	✓	✓		✓		✓					
Salmonellosis	12-72 hours	Contaminated food and water	Salmonella	✓				✓	✓	✓				
E. Coli	3-4 days	Contact with feces, close contact with contaminated food/water	Escherichia Coli	✓			✓		✓	✓				
HAV	15-50 days	Contaminated food and water, person to person contact, poor hygeine	Hepititis A Virus	✓	✓				✓	✓	inflammation of liver			
Fish Poisoning	1/2 hour-3 hours after consumption	Consumption of undercooked or partially decomposted fish	Gambierdiscus toxicus	✓			✓				sweating	malaise	paraesth-esia	
Tapeworm infection	10-25 days	Consumption of undercooked meat or ingesting larvae eggs	T. solium, T. saginata, Hymenolepsis	✓	✓	✓		✓	✓		loss of appetite	neurocysticer-osis	anemia	
EPIDEMIC CHOLERA	5 hours - 5 days	Contact with feces, close contact with contaminated food/water	Vibrio Cholerae	✓	✓		✓	✓	✓	✓	tired/ lethargic	dry mouth		

The first cholera epidemic to reach Pennsylvania was in Philadelphia during 1832. The Asiatic cholera left India during 1817, reaching Western Europe by 1831. Aboard immigrant ships, the epidemic was carried to North America during the year 1832, striking Philadelphia during July of that year. Presumed an epidemic phase of an indigenous summer diarrhea due to filth in the city, the College of Physicians did not believe that cholera was spread via contagion. They thought that the poor, immoral, and some specific ethnic groups were more at risk to be victims of the disease. In order to offset the conditions of the city, the Board of Health cleaned the streets, set up hospitals for treatment, and educated the public on proper precautions (see figure 2). Three months later, in September, 1832, the death rate in Philadelphia due to cholera had risen to 935.[14]

Living in even worse conditions than the rest of the city of Philadelphia, 141 inmates had died of cholera in the Arch Street Prison. To combat the poor living conditions and the spread of the disease, inmates that were not convicted of major crimes were released. The epidemic caused many to flee to Chester, Berks, and Lancaster counties, bringing cholera with them. Philadelphia's death rates were only one-quarter of New York City's and one-twelfth of those in Montreal during the same time. In 1849, the cholera epidemic returned to the city of Philadelphia killing 1,012 people. Immigrants that were traveling by railroad to Columbia, Lancaster County, carried the epidemic with them in 1854 killing 127 people. [15]

Figure 2. Cholera Prevention Poster



NOTICE.

PREVENTIVES OF

CHOLERA!

Published by order of the Sanatory Committee, under the sanction of the Medical Counsel.

BE TEMPERATE IN EATING & DRINKING!

Avoid Raw Vegetables and Unripe Fruit !.

Abstain from COLD WATER, when heated, and above all from *Ardent Spirits*, and if habit have rendered them indispensable, take much less than usual.

SLEEP AND CLOTHE WARM !

DO NOT SLEEP OR SIT IN A DRAUGHT OF AIR.

Avoid getting Wet !

Attend immediately to all disorders of the Bowels.

TAKE NO MEDICINE WITHOUT ADVICE.

Medicine and Medical Advice can be had by the poor, at all hours of the day and night, by applying at the Station House in each Ward.

CALEB S. WOODHULL, *Mayor.*

JAMES KELLY, *Chairman of Sanatory Committee.*

Due to the fact that there is no evidence of there being a cholera epidemic in North America until 1832, and not arriving in Lancaster County until 1854, it can be assumed that General Edward Hand did not die during a cholera epidemic. However, if the obituary stated the correct cause of death of Hand, it is possible to have a segregated case of Cholera morbus that could have only affected him and not anyone else at Rock Ford Plantation.[16]

Since cholera is so virulent, infecting such large portions of a population, in Communicable Disease Epidemiology and Control: A Global Perspective, it is stated that "a profound diarrhea of rapid onset that leads to dehydration and death should be considered as a case of cholera until proven otherwise".[17] If this was the case in 1802 when General Hand died, there likely would have been some record of the epidemic.

Another indicating factor that could support the theory of non-epidemic cholera lies within an issue of the Lancaster New Era the week before Hand's death. Advertised for sale is a product called "Hamilton's Grand Restorative" which is said to have been an unparalleled proven cure for such illnesses as loss of appetite, nervous disorders, impurity of blood, violent cramps in stomach and back, and indigestion, among many others. Also advertised is "Hamilton's Worm Destroying Lozenges" which are said to have cured irregular appetite, purging, vomiting, slimy stool, pain and sickness of the stomach, slow fever and sometimes paleness.[18] The advertising of these specific elixirs indicates that people in early America were having infections due to unknown illnesses and/or a tapeworms. In verifying the symptoms that were listed, the symptoms were found to be similar to those described in Cholera morbus or non-epidemic cholera.[19] These similarities can give researchers another indication of what could have led to the death of General Edward Hand.

Epidemiology of Cholera:

An example of how cholera was spread in the 19th century is the cholera pandemic that invaded much of Europe and Asia in the 1830s. Beginning in India during the rainy season, cholera was spread primarily along shipping routes and pilgrimage routes.

In 1830, cholera spread northwards from Persia and reached Baku on the Caspian Sea, then spreading to most parts of Europe, North America, Arabia, Asia, East and North Africa, and Russia. After a brief lull in the infection during the winter, the arrival of the spring of 1831 brought the pandemic back to life and it continued to spread again, primarily along shipping routes. In spite of quarantine measures, cholera was carried by the sailors on ships to Prussia and the rest of Europe. In England, the cholera epidemic became manifest in the port of Sunderland and by the end of 1832 had seen 14,796 cases with 5,432 deaths.

Throughout the 1830s, the cholera pandemic continued to ravage much of the world with outbreaks occurring primarily along shipping routes and pilgrimage routes and then spreading to the interior of the countries. The epidemiology of the cholera pandemic of 1830 is an example of how virulent an epidemic can be and shows that these conditions did not exist in Lancaster at the time of General Edward Hand's death in 1802.

Cholera Today:

Although much of the world has been able to prevent cholera outbreaks by providing clean water to its people, there are still some areas of the world where cholera remains a source of illness and death. In August of 2012, multiple patients had arrived in Cuban hospitals appearing to be suffering from a case of food poisoning. Dr. Julio Cesar Fonseca Rivero of the Celia Sanchez Manduley Hospital reported that 30 to 32 patients would come in a single day complaining of diarrhea and sickness. Food poisoning was ruled out as the reason for the sudden onset of illnesses and further testing revealed that cholera was the cause. The outbreak infected 417 people and killed three according to Cuban records. The Cuban heat and heavy summer rain are assumed to have caused the spread of the epidemic. It is likely that flooding and run-off caused wells to become contaminated with the cholera bacteria.20 Another modern day outbreak includes the 272 victims of confirmed cholera cases in Kurdistan, Iraq in October of 2012. The contaminated water sources and wells in Kurdistan are reported to be a result of a crumbling infrastructure due to the hard trials of war and neglect.21 Ten months after the devastating 2010 earthquake in Haiti, a cholera epidemic occurred which, by the end of 2012, has killed more than 7,900 people. Within the first ten weeks of the epidemic, cholera had spread to all of Haiti's ten provinces and spread to the neighboring Dominican Republic. Since the beginning of the epidemic, six percent of Haitians have had the disease.

Conclusions:

Since there was no evidence of epidemic cholera in North America until 1832, it was unlikely that an epidemic caused General Edward Hand's death in 1802 at his Rock Ford Plantation. With his obituary stating that his sickness lasted only hours, it is more likely that he died from a non-epidemic cholera such as another type of gastroenteritis (Salmonella, E. coli, typhoid, or various food poisonings). Though the historical record is not detailed enough in the events and onset of General Hand's death, research has determined that General Edward Hand did not die from epidemic cholera. After consulting with Fred Young, MD, a retired Lancaster Gastroenterologist and Edward Hand Medical Heritage Foundation board member, it was agreed that, with the information available, and the fact that no other members of the Hand household died, Hand's cause of death was most likely a gastrointestinal bacterial disease. Although the 1802 Cholera morbus diagnosis appears to have been correct, given its context and the time-period, historians and biographers neglected to include the word "morbus" in their writings. This has led readers to the misconception that General Edward Hand died with epidemic cholera.

1 (Cholera Epidemics in the 19th Century 2012)
2 (General Edward Hand 2009)
3 (Cholera 2000)
4 (Snow n.d.)
5 ibid
6 (Medical Dictionary n.d.)
7 (Bowen 2000)
8 (Cholera 2000)
9 (Obituary 1802)

10 (Rudy's List of Archaic Medical Terms 2012)

11 (Webber 2009)

12 (Cholera 2000)

13 (Osborne 2010)

14 Ibid

15 (Osborne 2010)

16 (Obituary 1802)

17 (Webber 2009)

18 Lancaster New Era (Hamilton's Grand Restorative 1802)

19 (Webber 2009)

20 (Oppmann 2012)

21 (Reuters 2012)

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