2003 Second Place Informative Research Paper

Gassed by What?

A Case Study of Mustard Gas Dependent on Historical and Physiological Studies in Gas Warfare

Foreword

I initially became interested in researching this topic after interviewing my grandfather, Donald Smith. I was assigned to write about a family story, its historical context, and how my life had been personally affected by it. My great-grandfather, who lived a very exciting life, full of unlikely twists and turns, was the focus of the story. For example, because he lived in a very rural town in Illinois, school was only taught up to eighth grade. After graduating, my great-grandfather was offered the school’s sole teaching position because the current teacher quit.

Moreover, E.Y. was the smartest boy to come out of the school and could also keep control of the students in the one room schoolhouse. Then, he was sent to serve in the military, and after escaping death at the hands of WWI, he wanted to attend college, so that’s what he did. He began attending Carbondale State Teaching College without registering or paying tuition. Administration found out, and he was only allowed to stay after a teacher sided with him and after the financial aspects were settled. When he passed away, Earl Young Smith had obtained a Master’s degree and was a fully accredited professor at Cornell University, all without ever attending high school.

However, I am most intrigued with his service in the United States Army during WWI. A miraculous recovery from a gas attack, tuberculosis, blood poisoning, and shrapnel in his arm, which required removal of four inches of bone from the forearm, are especially interesting. Of these, I am most interested with the gas attack. I had two sources of motivation that helped me write this research paper. First of all, I have always been
interested in WWI, specifically anything medically related. Second, this research paper struck a personal note because it is about somebody related to me. My audience is anybody interested in gas warfare during WWI, but specifically my family. My purpose is to increase awareness about the effects of gas warfare; however, this was not occurred without some difficulty. It was difficult to sort out which medical information was especially pertinent. There were a lot of medical aspects of the different gases that got very technical, which I did not get into. Instead, I steered towards only the very basic aspects. If possible, I would like to write a longer research paper that includes these more in depth aspects. With all this said, I do feel like I accomplished what I intended. There is always some uncertainty, but I feel fairly confident of my analysis in ascertaining which gas E.Y. encountered.
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Abstract

Michael Brodeur, in his research paper, “Gassed by What? A Case Study of Mustard Gas Dependent on Historical and Physiological Studies in Gas Warfare” asserts that Earl Young Smith was gassed with mustard gas during the Second Battle of the Marne. Brodeur initially gives a brief background of the use of poison gas. Then, Brodeur supports his assertion by describing the most common poison gases of WWI, namely chlorine, phosgene, chloropicrin, and mustard. More detail, encompassing historical aspects and medical aspects, is given for mustard gas. Brodeur’s purpose is to discover what gas his great-grandfather encountered, and to give the reader a basic understanding of some poison gases used throughout WWI. Using historical context and medical and physiological context, Brodeur concludes that Earl Young Smith inhaled mustard gas. His intended audience is the lay reader who is interested in a more in-depth look into poison gas applied to a specific case, and in particular, relatives of E.Y. Smith.
Gassed by What? A Case Study of Mustard Gas Dependent on Historical and Physiological Studies in Gas Warfare

April 22, 1915: French and Canadian forces are fighting against German forces in the Second Battle of Ypres in what is about to become a battle that will rock history books. The German forces are successfully launching the first recorded gas attack in World War I. Will Irwin, a foreign news correspondent for the New York Tribune, reports that, “[The] vapor settled to the ground like a swamp mist and drifted towards the French trenches on a brisk wind. Its effect on the French was a violent nausea and faintness, followed by utter collapse” (Irwin). According to Birdsell and Kleber in The Chemical Warfare Service: Chemicals in Combat, the chlorine plume originating from compressed gas cylinders hits the French forces and causes a wave of injury and panic. Nearly 15,000 French soldiers are injured, with 5,000 dead, according to German estimates (5). In a foreshadowing quote, from the New York Tribune, Irwin noted that gas “will doubtless become famous in this war” (Irwin). Three years later, sometime between August and September, Earl Young Smith was fighting bravely for the United States Army in the Second Battle of the Marne. During that battle, which characterized the Allies’ first major offensive for 1918, Smith was gassed. Until now, Smith’s family has not known what gas caused his lungs to atrophy. It is not known whether Smith himself knew or not. Using historical context and medical parallels, it was determined that he was gassed with mustard at the Second Battle of the Marne, which caused him to lose a lung and almost lose his life.

The Use of Poison Gas

The initial chlorine gas attack at the Second Battle of Ypres in 1915 against French troops clearly broke laws defined at the International Peace Conference during the Hague Convention. “[P]rojectiles, the sole object of which is the diffusion of asphyxiating or deleterious gases,” were banned during this conference at The Hague, Switzerland in 1899 (Birdsell and Kleber 6). However, once the law was violated, poison gas was poised to become a major battlefield tactic, and throughout the course of WWI, a total of 28 gases and 16 gas mixtures were used by the Allies and Central Powers (Birdsell and Kleber 3). Palazzo in his book, Seeking Victory on the Western Front, records that of these, the most common poison gases used, in order of introduction, were chlorine, phosgene, chloropicrin, and mustard (82).
Birdsell and Kleber report that chlorine gas was initially used because of its widespread availability and was stored in cylinders because it was easiest to store and transport using cylinders. However, gas masks were soon created, other gases were developed, and troops were increasingly ready for a chlorine attack, so the effectiveness of using chlorine was diminished significantly. Moreover, chlorine gas was difficult to transport and place on the battlefield. Soon after, new gases were developed, and technology improved, allowing gas to be launched into specific places more easily. Thought was given to using exploding shells filled with liquid agents that would vaporize upon impact, but not much agent was able to fit inside, and the agents often ate away the ballistic shell encasing. Soon the door of gas warfare was opened by the development of nonexploding shells that broke slightly open and contained concentrated gas (9-11).

**Chlorine Gas**

Chlorine gas was effective at first because of its novelty, but that soon waned. It had the ability to blind and to induce choking and coughing, which Bancroft et al. report in *Medical Aspects of Gas Warfare*, was because of quick reactivity with the respiratory tract and eyes (Birdsell and Kleber 5; Bancroft et al. 83). Chlorine gas is classified as a lung irritant and by altering protoplasm, a semi-fluid constituent in the lungs, chlorine is dangerous and can be deadly (Bancroft et al. 83). However, towards the end of 1915 and the beginning of 1916, other gases were developed, and chlorine was usually mixed with other gases (Palazzo 79). Thus, because other, more potent gases were developed and effective defensive measures against chlorine were instituted by the time the Second Battle of the Marne occurred, it is unlikely that Smith came into contact with chlorine. Therefore it is safe to reason that Smith did not inhale chlorine gas.

**Phosgene Gas**

Being the second of the popular gases on the scene, phosgene was “the most effective of the lung-irritant group” (Bancroft et al. 84). It was first used in 1916 and made its debut in a mixture with chlorine (Palazzo 79). Bancroft et al. explain that at the outset, it does not irritate the corneal area or even the respiratory tract. In other words, its harmfulness does not manifest itself once phosgene is initially inhaled. However, once phosgene does start reacting, it begins to attack the tissues of the lungs, down to the level of where the capillaries reside. The damage of the tissue allows fluids to seep in, causing edema or swelling, which enlarges the lungs and results in
serious injury or death (84). However, Smith’s condition made his lung shrink, while swelling would be characteristic of edema caused by phosgene. Thus, it can be concluded that Smith did not encounter phosgene gas.

**Chloropicrin Gas**

Chloropicrin, the third of the popular gases on the battlefield, is another poison gas that is also a lung irritant (Bancroft et al. 82). First used at the Battle of Arras on April 4, 1917, it is lethal because it is very light and unstable (Birdsell and Kleber 13). Chloropicrin induces vomiting and was often used against the Germans, either by itself or in a mixture with other gases (Palazzo 125). According to Bancroft et al., “At moderate concentrations it produces lung edema, intense irritation of the whole [respiratory] tract, violent coughing, and retching” (84). Being very potent, it could seriously harm a soldier even 14 hours after the initial attack (Palazzo 99). Basically, the bodily reactions to chloropicrin considerably reflect the general responses to a lung irritant: destruction of the respiratory tract, coughing, and vomiting. One interesting note is that chloropicrin is always referenced with Allied use against the Central Powers. Thus, it is concluded that Smith could not have encountered chloropicrin for two reasons. First of all, he experienced the opposite of edema—one of his lungs shrank considerably—and secondly, no Central Power usage of chloropicrin is found referenced.

**Dichloroethyl sulfide (mustard gas)**

*Historical Aspects*

Dichloroethyl sulfide (mustard gas) is one of the most remembered gases used in WWI. According to Birdsell and Kleber, this vesicant was introduced by the Germans in July 1917. A vesicant is characterized by causing burning and inflammation of the body parts with which it comes into contact. Noteworthy is that it quickly pools in the lowest possible areas on the ground, which makes it an excellent candidate for use as a defensive measure (14). As troops retreated, the enemy forces crossed bomb holes throughout No Man’s Land, the area between two opposing trenches, and the trenches themselves, which were previously occupied by the retreating troops. Here is where mustard gas pools. Thus, the threat of mustard gas slowed down an advance and also made it difficult to traverse an area. As WWI progressed, its use became more popular. Palazzo records that the British demand for mustard accounted for 101,000 out of 130,000 chemical shells per week. From 1918
to 1919, the British requested that 147,000 out of the 174,000 chemical shells be mustard. Besides a jump in sheer volume of mustard shells requested, the percentage jumped from 78 percent in 1917 to 84 percent from 1918 to 1919 (122-123, 158).

**Medical and Physiological Aspects**

Differing from the other lung irritants, mustard gas is also an eye, nasal, and skin irritant (Bancroft et al. 84). Actually, it is more appropriate to refer to mustard as a vesicant rather than a full-blown lung irritant. A vesicant is a chemical gas that affects the skin and eyes, and the respiratory tract if inhaled (Bancroft et al. 259). As an eye irritant, it produces symptoms several hours after a soldier’s exposure, and usually injures the corneal area, summoning conjunctivitis (Bancroft et al. 83). If mustard is taken in through the nose, there could be sneezing, vomiting, and/or coughing due to irritation of nerve endings in the throat and nose (Bancroft et al. 85). Also, as a skin irritant, “[m]ustard gas was an insidious weapons, and although a mask afforded protection from fatal poisoning, its ability to blister made its effect on the skin…a torment for its victims” (Palazzo 185). Furthermore, as a lung irritant, necrosis, or death of cells in a certain area, and inflammation often occurred (Bancroft et al. 263). However, “[t]he characteristic pulmonary edema of the lung-irritant gases was not present in intoxications with the vesicants” (Bancroft et al. 263). Thus, in a medical sense, its effects were vastly different than the other lung-irritant gases because it caused burning but not edema.

**The Analysis**

**Historical Context**

Using this information on the basic poison gases as well as some historical information, the claim will be made that Earl Young Smith was gassed with mustard gas at the Second Battle of the Marne sometime between August and September 1918. Donald Smith, Earl’s son, recalled that “He was either gassed in the Second Battle of the Marne or the battle for Belleau Wood” (Smith 25 Oct.). The battle for Belleau Wood took place from June 1 to June 26, 1918 (Belleau Wood). The Second Battle of the Marne, on the other hand, occurred from July 15 to September 16, 1918 (Marne). That establishes the high probability that Smith was gassed at the Second Battle of the Marne, since it occurred later. Smith knew that Earl Young fought in both, so the battle occurring later would be the one in which he was gassed (Smith 25 Oct.). Furthermore, a website
created by the Great War Society about the Battle for Belleau Wood declares that Belleau Wood is located near the River Marne (Belleau Wood). Thus, it is feasible to imagine Smith’s being transferred to the Second Battle of the Marne after combat in the battle for Belleau Wood.

Moreover, according to a website also created by the Great War Society about the Second Battle for the Marne, towards the end of the Second Battle of the Marne, Germany changed from an offensive (their last in WWI) to a defensive stance, while the Allies gained their first offensive victory for 1918. During the last phase of the battle, the Germans used massive amounts of mustard gas, since they were retreating and mustard is generally used in defensive situations for reasons already discussed (Marne). Another advantage of using mustard in defensive situations is that even if it didn’t kill the soldiers, they would usually be injured enough to require being taken to a hospital away from the front lines, which would severely diminish the power of an offensive attack (Birdsell and Kleber 14). It is likely that mustard was used to offset the Allies’ offensive attack and thus, it would be apropos to conclude that Smith was subjected to a mustard gas attack since the Allies would be on the offensive and encounter the large deposits of mustard.

Medical Context

Moreover, according to Donald Smith, one of Earl Smith’s lungs atrophied, and then he developed tuberculosis, most likely from the unsterile environment in a WWI hospital. An x-ray of his chest “looked like one lung and one walnut” (Smith 29 Sept.). Obviously, he was gassed with a poison gas that would irritate his lungs. Furthermore, the symptoms Smith experienced bear striking resemblance to those from a mustard attack. Instead of having the edema characteristic of true lung irritant gases, one lung atrophied and shrunk, probably from the necrosis of the cells in that lung.

Conclusion

Through a careful examination of the history and medical effects of poison gas in WWI, it can be concluded that Smith was subjected to a mustard gas attack. Smith was definitely gassed by a lung-irritant; however, there were four common lung-irritant gasses used during WWI, namely chlorine, phosgene, chloropicrin, and mustard. The first three are similar in effect on the human body, but mustard has some definite
differences, which reflect the symptoms Earl Young Smith experienced. Specifically, mustard was also present
at Smith’s last battle and was not uncommon for a response to the offensive move the Allies were making.

From the development of chlorine gas in the Second Battle of Ypres even before the
United States entered WWI to the use of mustard gas in the Second Battle of the Marne towards the end of the
Great War, gas was an instrument of death and injury. Cases like Earl Young Smiths are very beneficial because
they allow for examination of what gases can do to the human body.


Smith, Donald. Personal interview. 29 Sept. 2003.