An *in silico* Approach to Understanding Pain Associated with the Chest Tube
(Technical Report)

Pomeroy Bullets Take Down German Zeppelins in WWI: A Technological Politics Analysis
(STS Research Paper)

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By

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A Socio-Technical Synthesis: Chest Tube Stabilization and WWI

Trauma is the leading cause of death for younger individuals, and approximately one-quarter of those deaths are attributed to primary thoracic injury. In my technical capstone project, I engaged in research regarding pain associated with chest tubes and the thoracostomy procedure. In WWI, there were approximately twenty million deaths, many of which were due to traumatic accidents, requiring the use of chest tubes. My STS research was conducted on the employment of the Pomeroy bullet, which was responsible for the takedown of the menace that was the German Zeppelin during the bombings on London during the Great War. Therefore, there were undoubtedly cases wherein Pomeroy bullets as discussed in my STS research paper were implicated in the use of chest tubes, where my technical project reigns.

The first major technical achievement made this year was with an IRB-approved survey that was sent to over 1200 healthcare providers of different specialties at university hospitals throughout the nation. Doctors, nurses, physician assistants, and respiratory therapists were probed with questions regarding the pain that patients with chest tubes experience. The results of our survey suggested to us that the pain is distressing to patients, and that its origins are in the intercostal space and at the subcutaneous suture site. These novel findings have proved instrumental in informing the design of a chest tube stabilization device that will help to alleviate the pain by minimizing stress at the insertion site of the tube. My partner and I have been able to 3D-print two stabilization device prototypes, and more importantly, were able to design an anatomically correct chest and chest tube model via computer-aided design with Autodesk Fusion 360 software. In doing so, we have constructed eight distinct iterations of the model, and have perfected it so as to include biomechanically accurate mechanical properties such as

Young's moduli and shear coefficients so that finite element analysis reliably produces stress readings.

As touched upon above, in my STS research paper, I discussed the design and employment of John Pomeroy's incendiary bullet, which gave the British Royal Flying Corps. a distinct advantage in the air-fought war over London throughout WWI. Prior to their use, the giant German airships called Zeppelins reigned over Britons, and took the lives of many innocent civilians – including babies. It was only when the Pomeroy bullet was implemented into the ammunition supplies of the British military that the weakness of the Zeppelin ships was exposed – the monstrous bags of hydrogen gas that kept their previously impenetrable steel frames afloat. Because the bullets were incendiary, they were able to not only cut through the steel frames, but more importantly light aflame the highly flammable gas that resided inside. This technology had significant political agency in this manner, because it highly advantaged the British in comparison to the Germans. Thus, technological politics proved useful in examining this case.

By studying these two very different topics simultaneously, I was able to grasp a more real-life understanding of how a novel stabilization device to minimize pain might be invaluable. During a wartime, injured soldiers with all sorts of wounds need nothing less than pain from interventions that are designed to help them. In other words, if a traumatic accident like the crashing of a plane indicates the use of a chest tube, it is vital that the chest tube itself does not inflict more pain upon the patient. Therefore, throughout my research in both realms, I have had the privilege of reflecting on this, and the idea that even things as seemingly distinct as bullets and chest tubes do have societal commonalities that are worth examining.

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