

Silencing Pain Amidst the Gunfire World War I and the Development of Anesthesia

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In any military engagement, pain and suffering invariably occur. For wounded soldiers who survived long enough to receive medical treatment, the agony of the wait may have been only a prelude to the pain that was yet to come on the operating table. This was often the case in wars before the refinement of anesthetic techniques, when it was not uncommon that a soldier might fear the surgeon more than the enemy. The soldiers of World War I were fortunate compared to those of earlier conflicts who fought without any benefit from anesthesia. Yet pain relief was still in its infancy. It soon became acknowledged that anesthetics deserved much more recognition than they were being given, leading to significant advancements in the field. The trying conditions of World War I primed anesthesia for rapid development. During a time when pain relief was most urgently required, better anesthetics and techniques were developed and deployed. It is ironic that war played such a major role in the evolution of anesthesia; that which caused so much pain also numbed it.

The Great War began on August 1, 1914, throwing 32 nations into a 4-year global conflict where suffering was nearly universal. Anesthesia was caught unprepared, having stagnated in progress since its hesitant applications during the Crimean (1854-55) and U.S. Civil (1861-65) Wars. Chloroform and ether were old friends to the surgeon and quickly took their places at his side. Novocaine, a potent local anesthetic, was introduced in 1905 but remained under the monopoly of Germany. Block or regional anesthesia, numbing a specific area of the body supplied by a nerve, was still very new with only a few surgeons having mastered the technique. Spinal, intravenous and rectal anesthesia were still in experimentation and while barbiturates were used as soporifics, they had not yet been adapted to anesthesia. Gas anesthetics, such as nitrous oxide, were impractical to store in glass bottles, and were restricted to hospitals where they were contained within cumbersome iron supply tanks (1). Primitive endotracheal intubation was used to admit gases directly into the lungs without an understanding of controlled ventilation or of even a need for it. The absence of standards in equipment gave rise to ingenuity and imagination among the surgeons.

The proverb, necessity is the mother of invention, most certainly applied to the field of anesthesia during WWI. Its inadequacy in the face of such widespread agony spurred hasty development. Experimentation in mixing various gases gave rise to many widely used formulas, among them ACE (alcohol, chloroform, ether) and ECE (ethyl chloride, chloroform, ether) (2). The importance of adequate ventilation and oxygen were soon realised, as the sustaining gas was incorporated into anesthetic mixtures. "With gas-oxygen we cut down the mortality from about 90% to something like 25%," reported war surgeon Geoffrey Marshall (3). While surgeons once prided themselves in their abilities to carry out procedures timed in the seconds, the addition of oxygen permitted more complicated operations to be carried out,

sometimes lasting hours. Nitrous oxide-oxygen mixtures became even more practical with the introduction of devices that accurately measured their concentrations. An American specialist in anesthesia, Dr James Gwathmey, carried out considerable research designing equipment that could deliver with precision nitrous oxide-oxygen mixtures. The new gas machine from England was able to provide a steady flow with uniform pressure. Soon after, as standards of safety were established, nitrous oxide came to be ranked as a safer gas anesthetic than ether and chloroform (2). Other devices focused on portability and convenience for the mobile armies. One such device was the Flagg can, used for administering ether (4).

Accompanying the absence of uniformity in anesthetic agents, techniques and equipment, an appropriate attitude toward anesthesia was also lacking. There were no rules governing who could administer anesthetics and those who did often did so without any training. Anesthesia fell under the jurisdiction of surgery, and was not seen as a specialty in its own right. Many physicians fought against this apathy, but their numbers were too few to turn the tide towards an increased awareness of the importance of anesthesia. Although they did exist, it was apparent from the beginnings of the war that specialist anesthesiologists could not meet the demands placed upon them by the war. A nurse admitted, "I spent most of my time giving anesthetics. I had no right to be doing this, of course, but we were simply so rushed... I went on giving anesthetics because no one else could be spared to do it." (5).

Two American anesthesiologists played crucial roles in taking the first steps to remedy the shortage of qualified people capable of providing anesthesia. Surgeon Dr George Crile, a pioneer in the use of regional anesthesia, took it upon himself to train nurses in the administration of anesthetics (2). The other was Dr Arthur Guedel, who pointed out in frustration that "the surgeon, no matter what his experience or rank, has full control of anesthesia for his cases, and as a rule he knows nothing about anesthesia." Guedel actively instructed hundreds of individuals on the safe administration of ether during WWI (2). Most of the advancements in manpower took place in what were known as casualty clearing stations (CCSs) located 7 to 50 miles behind the front lines. It was here that the influx of the wounded was so drastic that "anesthesia by experts came into its own." (5) It was not until half way through the war that specialists and specially trained nurses began to replace the convenient ad hoc medical officers in administering anesthesia.

When the war ended in 1918, anesthesiologists continued to fight with renewed vigour against pain and for the improvement of anesthesia, stimulating a new interest in the field. It has been said that WWI yielded only modest improvements in anesthesia and that advancement came only with the peace that followed (1). Without doubt, the physicians returning from the battle line accelerated the development of postwar anesthesia. The WWI experience paved the road for the future developments in anesthesia, priming its progress. It was immediately after WWI that anesthesia was revolutionized with the introduction of the wide-bore, single lumen endotracheal tube replacing the small, cuffless tube that was used previously (7,8). Rebreathing anesthesia machines and intravenous anesthesia came into being. Numerous papers were published including Gwathmey's text on the English Boyle machine, Guedel's landmark article on the eye signs of anesthesia (9), and Crile's official summary of anesthesia in the Great War for the Medical Department of the Army (5). Anesthesia began to emerge from the shadows of surgery. As physicians took interest in specializing in anesthesiology (9), independent departments of anesthesia were established along with residency programs mandated to oversee procedures, including transfusions and fluid therapy. The war had jump started the development of anesthesia.

By the time World War II began, anesthesia was indeed different and by comparison, much

better suited for the casualties of war. A different kind of war anesthesia was created from new drugs such as morphine, pentothal and procaine, and combinations thereof (1). Sodium pentothal's power was manifest when, at Pearl Harbour, many injured were regrettably killed with its use. Nitrous oxide, so highly praised by physicians during WWI, had come and gone. The anesthetic commanding the most respect became ether, now used with improved vaporizers and oxygen. Intravenous barbiturates attracted the military because of its simplicity, nonflammability and inexpensiveness (2). Techniques such as spinal anesthesia were better understood. Novel devices, including the syrette came to the mercy of many wounded soldiers. This one-time disposable hypodermic syringe for morphine, along with the newly discovered penicillin and sulfa drugs used for reducing the risk of infection, became standard issue (1).

Finally, the most important advancement was perhaps not any new chemical agent or machine, but simply the change in attitude toward the field of anesthesia: it was apparent that the military began to ascribe to anesthesia the importance that it deserved. As in WWI, anesthesia remained a subdivision of surgery at the beginning of WWII despite the repeated warnings of experts including Crile. But Colonel Frederick Rankin, consultant to the Surgical Division of the Office of the US Surgeon General, sought to not repeat the mistakes of the past and asked an expert to become the Consultant of Anesthesiology for the military. Chief of Anesthesiology at Hartford Hospital, Ralph Tovell requested, and was granted, full status as a Consultant, independent of surgery, and without precedent to follow. Tovell was sworn in as a Lieutenant Colonel, his military duties extending over 41 months in the European Theater of Operations (10). During this time, he did much to advance anesthesiology, focusing on 2 major problems: creating training programs that would yield competent staff for administering anesthetics and standardising equipment between the allied countries (11).

World War I initiated the rapid development of anesthesia. The incomprehensible amount of suffering that was without precedent sparked an urgency for pain relief like none before. This field of medicine started out in uncertainty, a small extension of surgery rather than anything whole, and slowly grew to become its own respected specialty. The journey began in World War I when it was realised that the current understanding of anesthetics and the devices available for its use were insufficient to treat the injured. Toward the end of the war, the attitude had changed, laying solid foundations for further innovations and discoveries. Without pain there would be no need for anesthetics. Thus anesthetic development saw much of its rise rooted in WWI and it could be said that the field owes much of its progress to this dark period in history.

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