



Original Research

A History of Intravenous Anesthesia in War (1656–1988)

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ABSTRACT

The practice of anesthesia in war places significant restraints on the choice of anesthetic technique used; these include, but are not limited to, safety, simplicity, and portability. Ever since intravenous anesthesia became a practical alternative, there have been military doctors who felt that this technique was particularly suited to this environment. The challenge, as in civilian practice, has been to find the appropriate drugs as well as simple and safe delivery systems.

The urgency of war has always stimulated innovation in medicine to counteract the ongoing development of weapons of war and their effects on the human body and to achieve improved survival as public expectations rise.

This article traces the development of and the use of intravenous anesthesia by military physicians for battle casualties. The story starts long before the era of modern anesthesia, and the discussion concludes in the dog days of the cold war. The rapidly increasing interest in intravenous anesthesia in both civilian and military practice since the early 1990s is left for other authors to examine.

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Introduction

Advances in military medicine parallel those in the civilian sector; the converse, of course, is also true. Developments in the field of intravenous anesthesia have been stimulated by military pressures, but the effect of the outbreak of war on medical innovation has always been unpredictable. Military anesthesia has certain requirements that have not in themselves changed so very much over the last century and a half. Whether intravenous anesthesia has been seen to fulfill these requirements has depended not only on the intravenous drugs available at any one time but also on contemporary anesthetic techniques against which any new method would be compared.

This article will describe some aspects of the history of intravenous anesthesia, the contribution of military personnel to its development, and its use in the military setting. In particular, the reasons why some techniques were accepted for use in the field will be examined.

Military Anesthesia

The ideal field anesthetic technique should be simple. It should be familiar to those using it. Equipment should be easily portable and robust to survive the rigors of maneuver warfare. Anesthetic drugs used in the field need to be easy to store, nonflammable, and nonexplosive,

and consideration needs to be given to administration in confined, poorly ventilated environments. Sykes¹ noted in one of his *Essays on the First Hundred Years of Anesthesia* that when the only available anesthetics were ether and chloroform and the operating room was confined and lit by oil or gas lamp, the medical staff would have to decide whether to risk either explosion by ether or poisoning by the phosgene produced by the action of heat on chloroform.

Battle casualties present unpredictably and often in large numbers; therefore, the preparation of the anesthetic should be rapid, and its administration at induction should be smooth. Equally important are rapid emergence and recovery to allow early evacuation. Considering the frequent physiological compromise of these battle casualties, the depth of anesthesia needs to be easily controlled during the surgical procedure.

War wounds often demand multiple surgeries, thus necessitating the availability of multiple alternative techniques or an anesthetic that can be administered repeatedly with impunity.

Finally, casualties often have multiple injuries, and damage to the head, face, and neck is common. Therefore, consideration of the potentially limited access to the airway during surgery is in order.

Early Developments in Anesthesia and Intravenous Infusions

There have been attempts to alleviate the pain of war wounds and surgery for centuries. Opium in particular had been used for millennia and was reintroduced into Europe in the early 16th century by Paracelsus (1493–1541), a military physician himself at times.

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Paracelsus also produced ether and noted its soporific effects on hens. Thomas Sydenham (1624–1689), known as the English Hippocrates, introduced opium in an alcohol solution to England and famously declared that “Among the remedies which it has pleased Almighty God to give to man to relieve his sufferings, none is so universal and so efficacious as opium.” As Sydenham’s medical studies in Oxford were interrupted by service in the Parliamentary army during the English Civil War (1642–1651), he was no doubt well aware of the suffering endured by the wounded.

At this point, intravenous use of opium was unavailable but was approaching fast. What was required was an understanding of the circulation and a means of injection. The former was supplied by William Harvey (1578–1657) in 1628 with the publication of *De Motu Cordis*. Harvey went on to be a physician to King Charles I. Another Oxford-trained physician to the King during the English Civil War was Thomas Willis (1621–1675), later a great rival of Sydenham’s. Willis was connected with the Oxford group that went on to form the core of the Royal Society. It seems that, at Oxford, Willis was present at the experiment performed in 1656 by Sir Christopher Wren (1632–1723; architect, physicist, astronomer, and, later, the Savilian Professor of Astronomy, University of Oxford, Oxford, UK) at which Wren used an animal bladder and a goose quill to inject opium in sherry into a dog and produce sleep.²

In retrospect, it seems perhaps astonishing that despite some of the finest minds in medicine and science devising a method to inject drugs into the newly understood circulatory system, no subsequent progress in the field of anesthesia was to occur for a considerable period.

Wren’s experiments were not published until 1665, the same year that Johann Sigismund Elsholtz³ (1623–1688; physician and naturalist, Germany) (Figure 1) published *Clysmatica Nova* in which he described his demonstration confirming Harvey’s theory of the circulation of blood and his own experiments on intravenous infusion in dogs and humans. In one experiment, Elsholtz injected a dog with an opium extract and produced a stupor such that the animal did not respond to being stuck on the back of the neck, to pressure on

an injured foot, or to pressure on or pricking of the tongue; it only responded briefly to plunging a needle deep into the tissue before falling back to sleep.³ After this, he sought volunteers “among the more intelligent sick people.”³ As physician to the Great Elector, Friedrich Wilhelm of Brandenburg, Elsholtz had contacts with the military and in particular with Andrea Horch, the head surgeon to the Elector’s bodyguard. Before long, 3 private soldiers volunteered to undergo infusion. These individuals were to be bled anyway for various reasons. So, after Horch had opened the vein, Elsholtz inserted his syringe and injected his potion. It is not reported whether these injections, which did not include opium, had any therapeutic effect, but this is probably the first recorded intravenous infusion by a military surgeon into a soldier.

The further development of the syringe occurred in the mid-19th century. Francis Rynd (1801–1861; physician) of Ireland produced a hollow needle in 1844, and both Alexander Wood (1817–1884; physician) of Edinburgh, UK, and the French physician Charles Pravaz (1791–1853) produced graduated hypodermic syringes in the 1850s. Wood used his invention to inject opium around nerves in neuralgic patients and noted the additional systemic effects. Ironically, Wood’s wife became an opium addict and died of an overdose injected by one of his devices.

The Early Modern Era of Anesthesia

Inhalational anesthesia got a head start in the 1840s, and it was not long before ether and chloroform were being used in war. There were well-reported objections to the technique. Sir John Hall, for example, senior medical officer with the British army in the Crimea, declared, “It is better to hear a man cry out lustily than for him to sink silently into his grave.”⁴ These attitudes merely reflected the caution, almost reluctance, in the general medical community to accept this new state of anesthesia that looked too like death to be good for you.

Meanwhile, on the Russian side of the Crimean frontline was another notable figure in this specialty’s history, Nikolai Ivanovich Pirogov (1810–1881) (Figure 2), a professor of surgery at the Military



Fig. 1. Johann Sigismund Elsholtz (1623–1688) and his experiments with intravenous injections.³

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