

1917

Carrel, A. The treatment of infected wounds

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“The Treatment of Infected Wounds,” Alexis Carrel’s Contribution to the Care of Wounded Soldiers During World War I

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I am delighted that *The Journal of Trauma* has accepted for publication a series of manuscripts addressing the prevention and treatment of septic complications associated with wounds sustained in combat trauma. The contributors reviewed current best wartime practices in neurosurgery, orthopedics, thoracoabdominal, and head and neck trauma. As was expected, extremity injuries have been and most likely will be the most common of all war type injuries and, additionally, associated with the most significant septic complications. Therefore, a historical perspective on this issue may provide a useful context.

In 1917, Dr. Alexis Carrel¹ published a monograph entitled *The Treatment of Infected Wounds*. In his introduction, Carrel states, “The suppression of wound infection would protect a large number of men from incapacity or death and would bring about the rapid restoration to health of the greater number of those whose anatomic lesions are compatible with life. Such progress would result in great saving in money and men.”¹ Our goals are no different today!

Dr. Carrel was alarmed by the fact that 70% of amputations were performed as a result of septic complications and not for anatomic reasons. It was also a common belief by many that the Listerian principles of antisepsis did not apply to war wounds. Sir Almroth Wright in 1915 wrote “the treatment of suppurating wounds by means of antiseptics is illusory, and that belief in its efficacy is founded upon false reasoning.”² Wright later expanded on his thoughts when he said “if it were ever to come about that an antiseptic sterilized heavily infected wounds, that would be a matter to announce in all the evening and morning papers.”³ Fortunately, Carrel, Dakin, and their colleagues were not dissuaded.

In the early stages of World War I, Henry Dakin and Alexis Carrel recognized that unprotected war wounds would promptly become infected with significant associated mor-

bidity and mortality despite debridement under anesthesia. They also recognized that the polymicrobial nature of these wounds and the difficulty in identifying specific organisms in a timely manner would make treatment by vaccines or serum a failure. A potential solution to this problem would be the development of a substance which was nontoxic to tissues but of sufficient bactericidal power to kill the offending microbes. This method was described as “chemio-therapy.”⁴

From September 1915 through 1916, Depage at the hospital in Panne (Belgium) and Pozzi at Compiègne, (France) were able to successfully close soft tissue wounds between the 4th and 12th day following injury and eventually heal fractures when those injuries were managed by debridement and wound sterilization with Dakin’s solution.^{5–7} In May of 1917, Sir Anthony Bowlby, Surgeon General of the Royal Army Medical Corps, acknowledged and thanked Dr. Carrel on behalf of the British surgeons for his contributions to the care of the injured and arranged for the implementation of the Carrel method not only at front and base hospitals but also in ambulances, trains, ships, and hospitals in Great Britain.

Carrel’s 227-page monograph, with charts, drawings, and photographs, details the decision-making process used to select Dakin’s Solution (hypochlorite of soda) by comparing its bactericidal property to other available solutions. Dakin’s was measured against silver nitrate, bichloride of mercury, iodine, hydrogen peroxide, acid salycilic, and acid carbohic. An entire chapter is dedicated to the technique of the manufacturing and storage, as well as the pitfalls and errors which could occur during this process.

Initial clinical observations of infected wounds and, eventually, of all wounds included identifying the microbiologic characteristics of the wound, including the number and types of microorganisms per high power field, as well as its healing characteristics by determining changes in the wound surface. The time at which an open wound could be safely closed was determined by the microbiologic evaluation of the number and type of organisms present in the wound. Only when the bacterial count was minimal were wounds closed by a variety of methods.

The authors insist in the manuscript that a successful outcome is predicated on using a technique that maintains the

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solution in contact with tissue. Several diagrams and drawings illustrate this easy-to-follow methodology. The last chapter, "Results," is replete with graphs, pictures, and photographs of a number of complex war wounds successfully managed.

Of note are 2 additional chapters that present content that remains relevant today. "The technique of the sterilization of wounds, mechanical, chemical and surgical cleansing of the wound . . ." emphasizes the importance of hemorrhage control and debridement, as well as the vascular and neurologic evaluation of patients in need of surgical intervention. Also "The Closure of Wounds" describes a detailed series of steps which continue to be appropriate at the present time in the management of wounds.

The manuscripts published in this supplement of *The Journal of Trauma* review the best currently available data to prevent and treat abdominal thoracic, neurosurgical, head and neck, and orthopedic combat-related injuries. Surgical techniques and antibiotic therapy are common denominators to them all.

The experience gathered in the pre-antibiotic era of local bacteriologic control is no longer a clinical option in contemporary trauma care. Topical therapy is commonplace in the practice of burn wound care. The time may have arrived to revisit the lessons learned 90 years ago by surgeons facing challenges similar to those of today.

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