The military surgical legacy of Vladimir Oppel (1872–1932)

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ABSTRACT: Vladimir A. Oppel (1872–1932) was a forefather of military trauma systems. As a surgeon in the Russian Army in World War I, Oppel experienced the challenges and inefficiencies associated with caring for large numbers of combat wounded, the inefficiencies he observed leading to unacceptable morbidity and mortality. As a consequence, Oppel envisioned a coordinated sequence of surgical care on the battlefield and developed the concept of "targeted evacuation." In his work, Oppel was among the first to propose the "right operation for the right patient at the right location at the right time." Central to Oppel's precepts were (1) the forward positioning of surgical care close to the point of injury, (2) the development of a reserve of proficient and deployable military surgeons, and (3) the provision of specialized surgery to optimize survival and reduce morbidity. Oppel's teachings were validated during World War II in the performance of the Soviet casualty evacuation system and in all modern wars modern since. Today, nearly 100 years after the work of Vladimir Oppel, the benefits of a coordinated or "targeted" trauma system, working to optimize survival after trauma, are well recognized around the world. (*J Trauma Acute Care Surg*. 2013;74: 1178–1181. Copyright © 2013 by Lippincott Williams & Wilkins)

The wounded patient needs to undergo the right operation at the right time and in the right place.

Vladimir A. Oppel, 1916

Get the right patient to the right place at the right time.

Brian J. Eastridge et al, 2006

In the history of medicine, only those outstanding personalities remain who were ahead of their generation and whose works and ideas influenced both current and subsequent events; the veracity of their views is proven by following generations. Russian military surgeon Vladimir Andreevich Oppel (1872–1932) was one such personality, and in 2012, the 140th anniversary of his birth was commemorated (Fig. 1). The visionary works of Oppel—especially those pertaining to the challenges of combat casualty care—form the basis of Russian war surgery doctrine including his most notable accomplishments related to efficient or "targeted" medical evacuation" within an organized trauma system.

EARLY YEARS

Born in 1872, Vladimir Oppel came from a family of Russified Germans who had been in the Russian governmental service since the 18th century. During the Patriotic War of 1812 (Russia–France), Oppel's great grandfather, medical officer Christopher Oppel, gave medical care to the injured in the burning of Moscow. Interestingly, Christopher Oppel was reportedly offered a position as a medic in the French Army by Napoleon although he refused, preferring to remain with the wounded.[1] For his efforts with the Russian Army, Tsar Nicolas I awarded Christopher Oppel an appreciation certificate "For Devotion and Diligence" and bestowed upon him the title of a State Councilor in Deed.

While studying in the Military Medical Academy in Saint Petersburg, Vladimir Oppel became fascinated by anatomy and surgery. He devoted himself to scientific activities and defended his thesis in 1898 at the early age of 26 years. In 1908, he was promoted to the position as Head of the Surgical Pathology Department at the Military Medical Academy. As an inquisitive surgeon and scientist, Oppel was interested in the importance of collateral circulation in the setting of extremity vascular trauma. Oppel recognized and eventually authored a well-known monograph on the ability of the collateral circulation to maintain limb viability in some instances of extremity arterial ligation.[2(p117)]

MILITARY YEARS

Before the beginning of World War I, Oppel displayed little interest in military medicine and surgery. However, as the war began, Oppel volunteered with the Russian Army and had his first experience without being assigned to a specific post. During this time, Oppel witnessed the tremendous burden of injury resulting from wartime mass casualty events. During these experiences, Oppel became discouraged by what he saw as the lack of organized patient care in the combat zone. He noted that although there were sufficient numbers of medical personnel in the Russian Army, the wounded troops suffered because of inefficient or poorly coordinated care.[3]

Even before World War I, it had been observed that on-scene or point-of-injury casualty care consisted only of moving patients out of the line of fire followed by quick attention to and bandaging of wounds.[4] Oppel's experiences in the war were similar as he observed abundant but ineffective facilities with the potential to provide incremental levels of casualty care. After

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Figure 1. Dr. Vladimir Andreevich Oppel (1872–1932) in a gown as an honorary member of the Royal College of Surgeons of England, London, 1913.

receiving on-scene care, Oppel observed that patients could be taken to forward dressing stations and division dispensaries and then to larger army and/or corps mobile hospitals and eventually large reserve hospitals at the rear of the battle.[5]

At the time, forward dressing stations were deployed within 1.5 to 3 km from the frontline, which meant that injured troops would be treated within 6 to 8 hours after injury.[4,5] At these forward facilities, physician care was limited and consisted of the application or revision of bandages using first-aid kits with cotton and soft gauze. Oppel and his colleagues documented that even basic maneuvers such as fracture immobilization, application of tourniquets, and administration of morphine were rarely performed at these facilities and that shortages of dressing material often prevented basic wound care.[4,6,7] The only emergency procedures documented at these forward medical facilities were the occasional tracheotomy to establish an airway or a minor vessel ligation to stop bleeding.[8]

Main division dressing stations were slightly larger facilities typically deployed in tents 3 to 6 km away from the frontline. Oppel observed that here patients could undergo amputation, larger vessel ligation, craniotomy, tracheotomy, or removal of projectiles from wounds. Although these intermediary facilities were supposed to be able to perform such emergency procedures, the absence of aseptic conditions and the lack of unified clinical instructions or guidelines severely restricted this capacity. Further complicating matters at this echelon was the shortage of experienced surgeons, which was so significant during Oppel's time that it prohibited the performance of many necessary procedures. The result was that patients were either delayed needlessly, receiving little to no care, or that these facilities were simply bypassed to evacuate patients as fast as possible to capable field hospitals at the rear of the battle.[4] It was only in the army field hospitals—often more than 10 km from the frontline—that the comprehensive realm of surgical procedures, including laparotomy, were able to be performed.

INEFFICIENCIES OF CARE NEGATIVELY IMPACT SURVIVAL AND RETURN TO DUTY

Oppel observed that the uncertainty resulting from various sources of medical logistics combined with the lack of clinical guidelines resulted in widely varied approaches to wartime injuries. This was hardly a recipe for successful patient outcomes, and Oppel noted instead that the casualty care structure resulted in a vicious system of "evacuation at any cost."[9,10] The mortality rate of patients recorded at various levels of care during Oppel's time supported his observation. Specifically, mortality at the forward or main dressing stations or medical units during World War I was only 1% to 2%, whereas larger, more capable surgical hospitals experienced mortality rates that exceeded 13%.[9] Oppel believed these findings were due to the delay in administering appropriate surgical care along the continuum of patient evacuation. Also of significance for the Russian Army were the low return-to-duty rates, which did not exceed 40% to 60%. This observation was in contrast to reports at the time that the French Army was able to recover and return to duty nearly 80% of their force injured in the war.[9,10] The Russian Army was losing the battle, as Oppel wrote, "because of the prevailing principle of evacuation at all costs." He wrote as an example that "injuries that with timely surgical intervention could result in favorable outcomes instead end in amputation because of delays in care, thus permanently disabling individuals."[9,10]

WRITINGS AND PRINCIPLES

Oppel developed an increased awareness of the drawbacks or limitations of care provided to those injured in battle and eventually developed the concept of "Etapé Treatment of the Wounded" (etapé—[Fr.] step, stage; i.e., staged treatment of the wounded). The essence of this approach was that "patient evacuation and necessary care did not have to be dissociated, but instead had to be connected."[3] In 1916, Oppel expanded his ideas in an article devoted to an innovative medical evacuation system in the *Russian Physician Journal*. In his 1917 book entitled *Organizational Issues of the Forward Surgical Zone* (Fig. 2), Oppel further elaborated on the importance of a coordinated trauma care and medical evacuation system in reducing morbidity and mortality.[3,9] These and other teachings by Oppel predate by nearly a century the principles of modern en route surgical and critical care widely embraced by military and civilian surgeons today.[11–14]

Oppel's fundamental principle was that those wounded in combat should receive the appropriate surgical care at the moment and place it is really needed and that the patient should be evacuated only as far from the frontline as is best for his health.[9] During the years after his initial writings, Oppel was criticized by some for the infeasibility of these goals. Although some in the military establishment took exception to the most challenging aspects of his propositions, Oppel persevered in pursuing the objectives of an ideal trauma care system made available to patients as soon as possible after injury. As evidence of Oppel's

Figure 2. A title page of the work entitled *Organizational Issues of the Forward Surgical Zone* dedicated to medical evacuation system written by Vladimir Oppel in 1917.

vision, the concepts he proposed related to a comprehensive trauma system have been adopted and shown to be effective during the recent decade of war in Afghanistan and Iraq.[11,13,14]

Oppel insisted on three principles within his medical evacuation system:

1. Surgical care as close to the wounded as possible.
2. Well-organized medical evacuation and creation of surgical reserves.
3. Specialized care in military hospitals within a framework of specific armies and fronts.

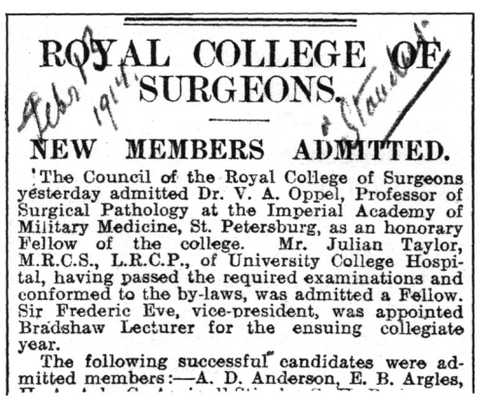
Oppel realized that a combat casualty care system was a challenging but necessary entity during the time of war. Speaking about the function of medical evacuation, he made the following statements, which, when viewed through the lens of time, are nothing less than visionary: "The question of the number of echelons is the question of the distance between these echelons, and this depends entirely on the means of medical evacuation."[9,10] Oppel suggested the mechanization of evacuation capabilities by using airplanes and "airliners of high-carrying capacity." He speculated that, "Upon the availability of fast-speed evacuation capabilities, it may be possible to evacuate patients requiring emergency surgery from the place of injury directly to the surgical hospital, bypassing intermediate echelons."[9,10] He concluded that "If evacuation capabilities allowed and the wounded could be evacuated with high speed, comparable to the speed of an express train, then after getting first aid they should be transported directly to the rear 200 to 300 versts away"[9] (nb, 1 verst = 1.067 km).

ALLOCATION OF ASSETS AND CLINICAL GUIDELINES

Oppel also proposed the accurate distribution of available military medical forces and facilities from the combat zone to rear echelons, including explicit guidelines for each. Oppel proposed that these clinical guidelines apply to the spectrum of care from simple wound bandaging to more complex surgical procedures. For organizational purposes, Oppel proposed that surgical operations be organized into three medical care echelons or categories: (1) wound debridement, (2) operative treatment of complications, and (3) rehabilitation. According to Oppel and other guidelines proposed at the time, injured patients arriving to the surgical facility should be divided according to the urgency of care needed. The point was to determine the categories of patients who require urgent surgery (i.e., within 6–12 hours). Further attempting to organize surgical care, Oppel observed three types of injuries that required urgent attention at early echelons: penetrating abdominal injuries, penetrating thoracic injuries, and serious soft tissue, bone, and joint injuries. As evidence of Oppel's awareness of the importance of the spectrum of care in optimizing outcomes, he also authored *A Guide to Caring for Patients*, which at least one source holds as the first Russian nursing textbook.[15] As Oppel organized the distribution of medical, surgical, and nursing assets throughout the theater of war, he maintained the priorities of optimizing survival and reducing suffering and incapacitation.

SCIENTIFIC AND LEGACY ACHIEVEMENTS

Oppel's expertise and study established him as one of the vascular surgery pioneers of the day among the likes of Carrel, Leriche, and Mattos. In an era before vascular reconstruction, Oppel recognized the phenomenon of ischemic tissue loss; and


ROYAL COLLEGE OF SURGEONS.

NEW MEMBERS ADMITTED.

The Council of the Royal College of Surgeons yesterday admitted Dr. V. A. Oppel, Professor of Surgical Pathology at the Imperial Academy of Military Medicine, St. Petersburg, as an honorary Fellow of the college. Mr. Julian Taylor, M.R.C.S., L.R.C.P., of University College Hospital, having passed the required examinations and conformed to the by-laws, was admitted a Fellow. Sir Frederic Eve, vice-president, was appointed Bradshaw Lecturer for the ensuing collegiate year.

The following successful candidates were admitted members:—A. D. Anderson, E. B. Argles,

Figure 3. A notification about the election of Vladimir Oppel as an honorary member of the Royal College of Surgeons of England.

Figure 4. The first in the World War Surgery Department and Clinic of Kirov Military Medical Academy (St. Petersburg, Russia) founded by Vladimir Oppel in 1931 (photo by professor N.F. Fomin). In the middle of the square—a monument to Professor S.P. Botkin, one of the most famous Russian physicians (1832–1889).

in the 1920s, he published works on what he termed "spontaneous gangrene."[15] Like generations of surgeons to follow, Oppel's in-depth research stemmed from his wartime experience with extremity vascular trauma. In this context, Oppel proposed unique ways to improve collateral circulation in an extremity, including vein ligation and even left-sided epinephrectomy (adrenalectomy).[16]

Oppel's achievements were recognized not only in Russia but also in Europe, and in 1913, his monograph on collateral circulation resulted in his election as an honorary fellow of the Royal College of Surgeons of England. Notably, he was elected at the same time as William J. Mayo, Harvey Cushing, and George W Crile. At the Royal College's reception, Professor Oppel, who spoke no English, "enchanted the audience by magnificent piano playing," which was not by chance because his father, AC Oppel, was a pianist and chair of the Russian Musical Society. Oppel was formally introduced to the Royal College of Surgeons of England and received the diploma of Honorary Fellowship the following year (Figs. 1 and 3).

Later in his career, Oppel expanded on a lifetime of military surgical experience authoring a publication entitled *War Surgery Sketches*. In this work, he outlined his vision of a trauma care organization that would include hospital collectors specialized for patients with cranial, thoracic, abdominal, bone, and joints injuries.[10] He proposed that advanced clearing stations be at the head of such a collector, designed not just to assign patients to specialized hospitals but also to administer surgical care to patients who had emergency indications en route; that is, the head of a collector was to play the role of "intermediate surgery." Later, having analyzed the activity of these hospital collectors, Oppel drew the conclusion about the expediency of the development of multipurpose hospitals with the same staff of surgeons.

As perhaps his crowning achievement, Oppel established the first Russian War Surgery Department and Clinic at the Military Medical Academy in Leningrad (St. Petersburg) in 1931 (Fig. 4). For more than 80 years, merit of Oppel's wisdom has been soundly proven, and his precepts taught through this department. Oppel's legacy lives through the War Surgery Department and the galaxy of eminent military surgeons that have emerged from it. Now, 80 years after his death and at the conclusion of a yearlong celebration of his life, it is highly appropriate to archive the accomplishments of Vladimir A. Oppel. Not since Dominique Jean Larrey and Nikolay Pirogov has one man considered with such detail the whole of a military trauma system and its importance in improving survival and reducing suffering on the battlefield.

AUTHORSHIP

All authors participated in reviewing the literature and designing, writing, and final editing of the manuscript.

DISCLOSURE

The authors declare no conflicts of interest.

DISCLAIMER

The views expressed in this article are those of the authors and do not reflect the official positions of the United States or Russian militaries or governments.

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