

Dominique Larrey (1766–1842) and Resuscitation of those Apparently Drowned on Military Campaigns

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Abstract

The history of military medicine highlights the casualty toll from disease and from shot and shell. A less documented but nevertheless significant cause of death was drowning. Thousands of soldiers perished from drowning at the Battles of Mülhausen (58 BCE), Alkmaar (1573), Blenheim (1704), Dettingen (1743) and Moscow (1812), and subsequently in both World Wars. Baron Dominique Larrey (1766-1842) is rightly credited as the founder of modern military medicine. In this role, he was also the first to recognise the importance of drowning as a cause of death on military operations. He was the first military surgeon to undertake (1805) experimental studies of drowning and to conduct autopsies on drowned soldiers. From these studies, he proposed enlightened approaches to resuscitation. His advocacy was strengthened by his own (sometimes successful) experience in resuscitating drowned soldiers. His doctrine, pioneering in the annals of military medicine, then as now, emphasised the importance of bystander skills of rescue and resuscitation for all, in both civilian and military domains.

Keywords

Dominique Larrey, resuscitation, apparently drowned, military campaigns

Introduction

Dominique Larrey, Napoleon's Chirurgien-Général and Inspector-General of the Medical Staff of the French Armies, is best known for his introduction of the battlefield

ambulance volante, the model of pre-hospital care today.¹ Larrey first described this innovation in a detailed report of the Italian Campaign in 1797.

He is noted also for his skill and speed in performing emergency limb amputations, ‘a primary treatment which for centuries probably saved more lives of the victims of serious limb trauma than any other operation that could then be afforded’.² It is reported that he performed 200 amputations in the 24-hour period after the Battle of Borodino on 7 September 1812.

He is noted also for promoting advances in many other domains of military medicine, including his advocacy for treating the wounded of both sides in battle, a concept formalised more than five decades later (1864) in the First of the Geneva Conventions.³

Larrey's contributions to resuscitation of the apparently drowned, a cause of death in the aftermath of many battles, is not widely addressed. He forged another link in the chain of bystander resuscitation, a chain that retains topical vitality, is still developing, and which leads to much debate today.

Drowning on Military Campaigns

Death due to drowning has a tragic history in the annals of warfare. The enormous loss of life from drowning, of sailors and merchant seamen of both the Allied and Axis powers in the two World Wars, remains vivid in contemporary memory. In earlier battles often a victorious army had chosen a field of combat adjacent to a river or the sea, such being a tactical barrier breached only by swimming, with predictable mortality. Five examples illustrate this point.

1 The Battle of Mülhausen (58 BCE)

At the Battle of Mülhausen in Germany Julius Caesar with six Roman legions and Gaelic cavalry defeated General Ariovistus (101-45 BCE), head of an army of seven Germanic tribes. Ariovistus, called Rex Germanorum by the Romans, was of the Suebi tribe and a formidable general. The Battle at Mülhausen was a bloody affair with much hand-to-hand slaughter. Publius Crassus, Commander of the Gaelic cavalry, turned the battle, the German line broke and the soldiers, with their supporting women, ran for the Rhine, 15 miles (24 km) away. It was said that ‘Ariovistus’ army took to its heels, and did not stay its flight until the Rhine was reached. Some succeeded in swimming it. Many were drowned’.⁴

¹ Skandalakis PN, Lainas P, Zoras O, Skandalakis JE, Mirilas P. ‘To afford the wounded speedy assistance’: Dominique Jean Larrey and Napoleon. *World Journal of Surgery*. 2006; 30: 1392–1399.

² Welling DR, Burris DG, Rich NM. The influence of Dominique Jean Larrey on the art and science of amputations. *Journal of Vascular Surgery*. 2010; 52: 790–793.

³ Burris DG, Welling DR, Rich NM. Dominique Jean Larrey and the principles of humanity in warfare. *Journal of the American College of Surgeons*. 2004; 198: 831–835.

⁴ Fuller JF. Mülhausen [58 B.C.]. In: Chandler D. (ed). *A Guide to the Battlefields of Europe*. Ware: Wordsworth Editions; 1989. p.108.

2 *The Siege of Alkmaar (August to 8 Oct 1573)*

At the Siege of Alkmaar the Spaniards under Don Frederic di Toledo determined to capture the Dutch city and market centre of Alkmaar, key to north Holland. The 16,000 strong Spanish army maintained an unrelenting siege assault on the walls of Alkmaar and the 1,300 armed burghers and 800 soldiers within. They held off the huge Spanish force for 48 days, before food supplies were exhausted. The burghers under Prince William the Silent (of Orange) defended the city by cutting the dykes and opening the Zyp sluices which flooded the polders in which the Spanish troops were camped. In his 1841 *History of Holland*, Charles Maurice Davies wrote:

[After] their supplies began to fail, they [the defenders] resolved ... on the desperate measure of cutting through the dykes. Some troops sent by Sonnoy having effected this, and opened the sluices, the whole country was soon deluged with water. Don Frederic, astounded at this novel mode of warfare, and fearing that himself and his whole army would be drowned, broke up his camp in haste, and fled, rather than retreated ... ⁵

Nevertheless, many Spanish soldiers were drowned. Don Frederic's resolution wavered and he abandoned the siege.⁶

3 *The Battle of Blenheim (1704)*

In the War of the Spanish Succession, the (First) Duke of Marlborough, Sir John Churchill (1650-1722), led an Anglo-Dutch force and defeated a Franco-Bavarian army under Marshall Tallard (1652–1728). The deciding battle, the Battle of Blenheim, was fought between the Danube River and one of its tributaries, the Nebel. One fifth of the Allied army was lost at Blenheim, but the Franco-Bavarians 'lost 15,000 prisoners and 13,600 dead (45 per cent of the 60,000 force) and many more were wounded and drowned in the Danube'.⁷

4 *The Battle of Dettingen (1743)*

At the Battle of Dettingen (27 June 1743) in the War of the Austrian Succession, King George II (commanding the Anglo-Austrian-Hanoverian-Hessian Army) defeated the French Army under the command of Marshal Adrien Maurice de Noailles (1678-1766). George II was the last ruling British monarch personally to lead his troops in battle.

The Battle of Dettingen is significant in the chronology of the development of the Geneva Conventions (1864) more than a century later, when the English Surgeon

⁵ Davies CM. *History of Holland*. London: John W. Parker; 1841. p.604.

⁶ Chandler DG. Alkmaar. In: Chandler D. (ed). *A Guide to the Battlefields of Europe*. Ware: Wordsworth Editions; 1989. p.244.

⁷ Jorgensen C. Blenheim 1704. In: Jorgensen C. (ed). *Great Battles*. Bath: Parragon; 2010. p.133-139.

General, Sir John Pringle (1707-1782), introduced the policy of treating both wounded enemy and Allied soldiers equally.⁸

At Dettingen there was enormous loss of life from drowning. In the final defeat of the French cavalry, the French footsoldiers saw the inevitability of imprisonment, wounding or death. When the French cavalry was overcome '... it was the signal for the whole of de Granmont's infantry to flee in disgraceful fashion, many being drowned in swimming the River Main'.⁹

5 The Retreat from Moscow (1812)

When Napoleon's army withdrew from Moscow in the winter of 1812, hundreds of thousands and their horses perished, some from military attacks but many more from starvation (due to the Russian 'scorched earth' policy) and from illness. Cold injury claimed tens of thousands.¹⁰

In that retreat, many soldiers were drowned in the Beresina River when masses of fleeing men were jammed on the bridge. Larrey himself was caught up in the crush but was recognised by the soldiers who passed him over their heads to relative safety. He subsequently described the disaster as the Russians arrived in enormous force:

... the soldiers of which division [of General Partouneaux] immediately wished to cross the bridge all at once. The conveyances clashed with each other. Some of the unfortunate men were crushed, while others, losing all spirit, threw themselves into the stream ... There was throughout a frightful mixture of imprecations ... thence arose indescribable disorder and a breaking of the overloaded bridge.¹¹

Larrey and the Management of Drowning

Larrey is best known for his invention of the *ambulance volante* which allowed him to bring organised first-aid and surgical care to the wounded lying on the battlefield. He was the first to describe, in the military context, the importance of resuscitation of the apparently drowned.¹²

⁸ Pringle J. *Observations on the Diseases of the Army in Camp and Garrison*. London: Printed for A. Millar, and D. Wilson, both in the Strand; and T. Payne, next the Mews-gate, near St. Martin's Church; 1752.

⁹ Duffy CJ. Dettingen [1743]. In: Chandler D. (ed). *A Guide to the Battlefields of Europe*. Ware: Wordsworth Editions; 1989. p.164.

¹⁰ Moricheau-Beaupré PJ, Clendinning J. *A Treatise on the Effects and Properties of Cold: with a Sketch, Historical and Medical, of the Russian Campaign*. Edinburgh: Maclachlan & Stewart; 1826.

¹¹ Larrey, Baron Dominique Jean. *Memoire of Baron Larrey, surgeon in chief of the Grand Armée. Translation from the French*. London; Henry Renshaw: 1861. p.157.

¹² Larrey DJ. *Memoirs of Military Surgery and Campaigns of the French Armies of the Rhine in Corsica, Catalonia, Egypt and Syria; at Boulogne, Ulm, and Austerlitz; in Saxony, Prussia,*

Larrey undertook animal experiments to determine the progression of drowning hypoxia. He established that, as consciousness is lost, the last sense to be preserved is hearing. His results were published in the *Moniteur* of 1805:

The organ of hearing ... is the last sense which is destroyed. Experiments which we made on living animals, confirmed these facts, and gave us likewise an explanation of the epiphenomena which attend the submersion of persons, and death from drowning.¹³

During Napoleon's campaign in the Maritime Alps (1794), Larrey on campaign undertook experimental studies on animal drowning and conducted autopsies on many drowned soldiers and reported:

[Following these experiments] I had the happiness of restoring some drowned persons to life – these means [of resuscitation], being generally known, may succeed in the hands of every one.¹⁴

Napoleon decried the practice of rolling a drowned victim over a barrel, a technique 'long popular with sailors and those living near the sea'.

Larrey employed warmth to the entire exposed body, friction to the skin and he experimented with '... blowing with a bellows into one nostril, at the same time closing the other; afterwards I press the thorax and the abdomen alternately'.¹⁵

He also wrote that he applied spirits to the mouth and an 'ammoniated feather' to 'irritate the inside of the nostrils'. He did this not to induce vomiting but as a respiratory stimulant. He rejected the American teaching of insufflating tobacco smoke into the rectum as having: 'I believe, in no well attested case, been productive of advantage ... On account of its nauseating effects we should be led to reject its use'.¹⁶ Larrey wrote this six years before its use was discontinued in 1811 when Sir Benjamin Brodie (1783-1862) showed that it could kill animals in experimental studies. Larrey cautioned against trying to make the drowned victim vomit as '... an emetick is prejudicial, on account of its propelling the blood towards this organ [the brain], in the paroxysms of vomiting'.¹⁷

Larrey's writings on the resuscitation of the apparently drowned reveal that he knew of the Dutch and British traditions of resuscitation which had evolved over the previous five decades. He brought to this subject an *a priori* lore of resuscitation, underpinned by his own animal experimentation of drowned animals, combined with his extensive experience of human autopsies conducted on drowned soldiers. This triad was complemented by his own (sometimes successful) experience in resuscitating drowned

Poland, Spain, and Austria. Volume 1. [Translated by R.W. Hall]. Baltimore: Joseph Cushing; 1814.

¹³ Larrey. *Memoirs of Military Surgery*, 1814 (Note 12). p.40.

¹⁴ Larrey. *Memoirs of Military Surgery*, 1814 (Note 12). p.38.

¹⁵ Larrey. *Memoirs of Military Surgery*, 1814 (Note 12). p.40.

¹⁶ Larrey. *Memoirs of Military Surgery*, 1814 (Note 12). p.40.

¹⁷ Larrey. *Memoirs of Military Surgery*, 1814 (Note 12). p.38.

soldiers. He was aware of the uncommonness of successfully resuscitating drowned soldiers:

Unhappily few drowned men are saved: but it is because life is generally extinct before the physician is called. On opening bodies, I have observed that the immediate cause of death, is the introduction of water instead of air, in the aerial passages; for the lungs are always heavier and produce less crepitus than in their natural state, and are filled, as well as the bronchiae, with a reddish frothy water ...¹⁸

Before Larrey's autopsies and experimental studies, in 1745 John Fothergill (1712-1780) had published a paper in The Royal Society's *Philosophical Transactions*, describing mouth-to-mouth inflation of the lungs.¹⁹ Fothergill had described the successful resuscitation of a suffocated man (unconscious for three quarters of an hour before rescue) and wrote:

The Method of distending the Lungs of Persons, dead in Appearance, having been try'd with such Success in one Instance, gives just Reason to expect, that it may be useful to others.²⁰

Also, at that time, William Hunter (1718-1783) noted that mouth-to-mouth resuscitation of stillborn neonates was universally used by the common people to resuscitate stillborn infants.²¹

Another pioneering Society which promoted bystander resuscitation was the Dutch *Maatschappij tot Redding van Drenkelingen*, founded in 1767. That Society had published rescue and resuscitation methods with some success in saving those who had been extracted, apparently dead, from the Amsterdam canals. These techniques were selectively adopted in Britain in 1774 by the newly established *Society for the Recovery of Persons Apparently Drowned*. In 1776 this body was renamed *The Humane Society* and thereafter, from 1787, *The Royal Humane Society*. In 1802 the Royal Humane Society presented its Medal to Mrs Ann Newby, Matron of the City of London Lying-In Hospital, 'for her successful resuscitation of 500 infants'.²²

Larrey's writings imply that he well knew of these contemporary best-practice drills of resuscitation of the apparently drowned. His significant contributions to this field of medicine were his own extensive practical experience of resuscitating drowned soldiers and of conducting autopsies on drowned men. His authority was greatly enhanced by his extensive experimental drowning studies on animals. This combination of clinical experience, autopsy studies and experimental work places him as one of the significant

¹⁸ Larrey. *Memoirs of Military Surgery*, 1814 (Note 12). p.38.

¹⁹ Fothergill J. Observations on a Case published in the last Volume of the Medical Essays, etc of Recovering a Man Dead in Appearance by distending the Lungs with Air. *Philosophical Transactions of the Royal Society*. 1745; 43: 275–281.

²⁰ Fothergill. Observations on a Case, 1745 (Note 19). p.277.

²¹ Bishop PJ. *A Short History of the Royal Humane Society*. London: Royal Humane Society; 1974. p.3.

²² Bishop. *A Short History of the Royal Humane Society*, 1974 (Note 21). p.3 & 5.

pioneers of the doctrine of prehospital care in this domain. By 1810 he was promoting urgent commencement of mouth-to-mouth resuscitation, warmth, the use of stimulants and bleeding as best practice first-aid for the apparently drowned.

Larrey was perhaps the first to describe the subjective delight of a resuscitator, when an apparently dead, drowned victim showed signs of life during resuscitation:

How is the surgeon transported, to discover motion returning to the lips and eyelids of a man apparently dead, and when he perceives that the heart palpitates, and respiration is restored! It is the rapture of Pygmalion, when he perceives the marble becoming animated under his fingers!²³

When he wrote this Larrey may have been referring to the motto of the [British] Royal Humane Society – ‘Perhaps a little spark may yet lie hid’. He also wrote about the moment when a resuscitator perceives that a flicker of life has possibly returned; and described his own response when ‘the torch of life is relumed’. The current author used this same metaphor when he coined the phrase ‘The Spark of Life’ as Convener of the first International Conference of the Australian Resuscitation Council, held in Melbourne in 1996.

Larrey wrote that when that first sign of life returned, he doubled his efforts of resuscitation. Larrey wrote that in his experience, ‘unhappily few drowned men are saved: but it is because life is generally extinct before the physician is called’. Larrey wrote this seven decades before Surgeon Major Peter Shepherd (1841-1879) in 1878 promoted the crucial necessity of skilled bystander resuscitation, rather than waiting for a doctor to arrive at the drowned victim’s side.

Aftermath

Larrey was to witness another great battle, the Battle of Austerlitz (2 December 1805), when, again, many soldiers were drowned. In the final hours of the battle Napoleon’s General Soult (1769-1851) partly encircled the fleeing Russian and Austrian troops, who ‘Assailed on all sides ... tried to flee across the [partly] frozen lakes, but the ice broke and many were engulfed’.²⁴

Tragically, loss of life from drowning and from immersion hypothermia claimed many thousands of lives of sailors, merchant seamen and soldiers as passengers on ships sunk in warfare in both the First and the Second World Wars. Many soldiers were drowned in training for the D-Day landings (6 June 1944) although at the time these tragedies were not made public since publication of their deaths was suppressed in the necessity of wartime censorship and security.

²³ Larrey. *Memoirs of Military Surgery*, 1814 (Note 12). p.39.

²⁴ Selby JM. Austerlitz [1805]. In: Chandler D. (ed.). *A Guide to the Battlefields of Europe*. Ware: Wordsworth Editions; 1989. p.49.

Dominique Larrey and Resuscitation of those Apparently Drowned (Pearn)

Larrey was called ‘Providence’ by his soldiers.²⁵ His doctrine, pioneering in the annals of military medicine, then as now emphasised the importance of bystander skills of rescue and resuscitation for all, in both the civilian and the military domains.

William Tossach was the first in 1732 to save life by mouth-to-mouth ventilation. Following Larrey’s experiments, a succession of nineteenth-century advocates proposed new methods of ventilating the lungs of the near-drowned – Marshall Hall (1856), Henry Sylvester (1858), Sharpey-Schafer (1903) and Holger Nielsen (1935). Subsequently, in 1956, Professor Peter Safar (1942-2003) in Pittsburgh demonstrated that a bystander could maintain satisfactory arterial blood oxygen levels, in a nonbreathing human, by mouth-to-mouth ventilation.²⁶ Baron Larrey’s pioneering experiments and advocacy for the importance of bystanders thus stand as one crucial early link in the historical chain which has saved the lives of many.



The Statue of Baron Dominique-Jean Larrey (1766-1842) in the Place Alphonse Laveran, Paris. Sculpted by David d’Angers. Photograph by Camillo Belkadi, 2014. The History of Medicine Topographical Database (himetop.wikidot.com). Creative Commons Attribution-ShareAlike 3.0 License.

²⁵ Hudson M. The enduring legacy of Napoleon’s surgeon-general. *The Baron Larrey Museum. Lancet* 2001; 358: 1378.

²⁶ Safar P. Ventilation and circulation with closed-chest cardiac massage in man. *Journal of the American Medical Association*. 1961; 176: 574.

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