

Staring Back Down the Barrel: The Evolution of the Treatment of Thoracic Gunshot Wounds from the Discovery of Gunpowder to World War II

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INTRODUCTION

Although the exact origin of gunpowder may never be accurately established, the Chinese are frequently credited with the invention of “black powder” during the 13th century and may have been the first to use it during warfare. With improvements in firing mechanisms and ballistics, the gun began to appear as an increasingly portable implement of the battlefield in the 1400s and has continued to evolve as a staple of modern warfare. This evolution necessitated a parallel improvement in the ability of surgeons to care for the projectile wounds to the chest that inevitably occurred.

These advances in care were made possible by several factors. The progression of time provided a greater accumulation of experience in the treatment of thoracic gunshot wounds and expanded insight into the physiologic responses associated with these injuries. The increasing portability of improved technologies also increased the diagnostic and therapeutic capabilities of the surgeon in the theater of conflict. Perhaps most importantly, however, progress was made possible by the actions of a select group of surgical innovators. Often through hard-learned experience, these individuals facilitated the translation of scientific progress into improved outcomes after thoracic gunshot injuries.

CHINA TO WATERLOO

Hieronymus Brunschwig of Strasbourg during the 15th century was among the first to provide a limited description of

“wounds shot with a gonne.”¹ Without the benefit of modern understanding, Brunschwig attributed the physiologic response to gunshot injury as being due in large part to the “venym of the powder” itself.¹ Over the next several centuries, although surgeons became more familiar with the wounds caused by a gunshot, little was written regarding the treatment of gunshot wounds of the chest. Significantly hindered by a limited understanding of physiologic response and the lack of more advanced diagnostic tools, surgical innovators of the day focused on therapeutics that primarily involved manipulation of the created superficial wound itself. A description of closure of a gunshot wound to the thorax was apparently described as early as the 16th century by the surgeon John de Vigo.² During the same time period, Ambrose Pare also wrote of his practice of closing these wounds, although he recommended that the closure should not be effected for 48 to 72 hours after injury to prevent the accumulation of blood. During the Napoleonic Wars of the early 19th century, Baron Dominique Larrey advocated positioning the patient with the wound down to allow gravity to assist with the drainage of open gunshot wounds to the chest prior to an attempt at closure.¹ For several centuries, attempts at the drainage of hemothorax would continue to rely largely on the wound created by the projectile as the primary route of drainage.

CRIMEAN WAR

Frequently described as the first conflict of modern warfare, the Crimean War spanned a period from 1853 to 1856 and provided the first useful descriptions of the treatment of thoracic injuries caused by bullets. According to Fraser,³ 474 of 12,094 wounds recorded in the Crimean War (3.9%) involved the chest, of which 135 wounds (28.5%) proved fatal. Fraser noted that among the 164 chest wounds with obvious pulmonary injury, the resulting mortality was 79.3%. The reported fatality

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FIGURE 1. Example of roentgen care developed by Marie Curie for front-line use during World War I.

rate for all wounds of the lung from the French Army in the same struggle proved even higher, at 91.6%.³

Still several decades from Wilhelm Rontgen's 1895 discovery of the x-ray, the diagnostic capabilities of surgeons from this period were limited to that which they could ascertain by symptomatology, which is auscultation and observations of the wound itself. Based on his own experiences with this limited clinical accumen, Fraser was among the first to propose the use of "paracentesis thoracis" for injuries in which blood accumulated in the chest without an open wound for spontaneous drainage. These efforts represented 1 of the first descriptions of active invasive intervention for hemothorax after gunshot wounds to the chest.³

THE AMERICAN CIVIL WAR

The American Civil War began in 1861, with the medical records of this struggle recording 253,142 injuries of which 20,607 (8.1%) involved the chest. Penetrating wounds comprised 8715 (42.3%) of these injuries, with a resulting mortality of 62.6%.⁴ The diagnostic and therapeutic limitations of the day had not significantly advanced in the brief period since the Crimean conflict and continued to preclude the common identification of such common entities as pneumothorax. Hemothorax and thoracic hemorrhage, however, had begun to be recognized as important entities. Although the practice of therapeutic venesection to arrest ongoing hemorrhage still saw sparse use, limited surgical approaches were increasingly employed for those sources of bleeding that were confined to the chest wall or previously exposed through an open wound. Patients with suspected residual hemothorax remained, however, relegated to treatment with such general measures as "acidulated drinks" and digitalis or opium administration by mouth.⁴

During this period, Samuel Gross first described a technique for control of intercostal bleeding: "a piece of fine linen is pushed into the wound, followed by a charpie, so as to form a small bag within the chest . . . by pulling this gently outwards

and fixing it, efficient pressure is made on the bleeding vessel."⁵ Aside from this prelude to the modern use of temporizing foley balloon traction for emergent tamponade of surgically inaccessible bleeding, an operation for control of hemorrhage of the thoracic vasculature was reported infrequently. A common

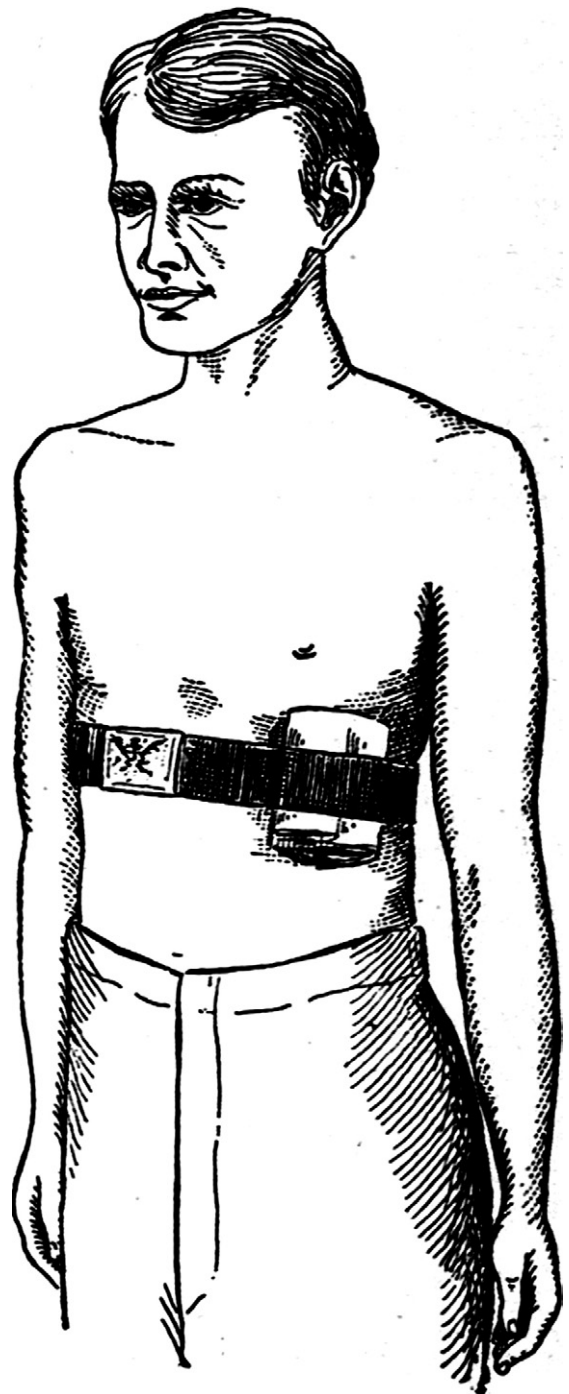


FIGURE 2. Use of chest binding as initial treatment of penetrating chest wound, early 20th century. (From *Practical Surgery for the General Practitioner*, Nicholas Senn, M.D.; WB Saunders & Company, 1901. Illustrator Mr. C.F.W. Eberhard).

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