

An odyssey of suturing cardiac wounds: Lessons from the past

Erwan Flécher MD, PhD¹  | Alain Leguerrier MD¹ | Nicolas Nessler MD, PhD²

¹Department of Cardiothoracic and Vascular Surgery, University Rennes Hospital, INSERM, LTSI-UMR 1099, Rennes, France

²Department of Anesthesia, University Rennes Hospital, Rennes, France

Correspondence

Pr Erwan Flécher, MD, PhD, Service de chirurgie thoracique et cardio-vasculaire, CHU de Rennes, 2 rue Henri Le Guilloux, 35000 Rennes, France.

Email: erwan.flecher@chu-rennes.fr

Abstract

Background and aim of the study: Cardiac wounds have been described for centuries and still remain to be fatal. For a long period of time, the suturing of a myocardial laceration was thought to be absolutely impossible if not sacrilege.

Methods: It is only at the end of the 19th century that pioneers decided to defy such a dogma in desperate cases.

Results: Nowadays, it seems obvious that a cardiac stab wound requires emergent surgery whenever possible.

Conclusions: The story of cardiac wounds highlights nicely the change of mind that is required to accept progress and new procedures in medicine.

KEYWORDS

surgical history

1 | INTRODUCTION

Cardiac wounds have been described for many centuries and the earliest known appeared in Homer's *Iliad*. To date, stab wounds to the heart remain a life-threatening injury. Their management is still highly challenging and requires immediate care and transfer to a surgical atmosphere. Even today, despite medicalized helicopters, ambulances, and the presence of well-distributed hospitals in our territory, a penetrating cardiac wound proves often fatal. Moreover, it was only 123 years ago that the first successful repair of a cardiac wound was reported, passing through a long history of mysticism and medical criticism. Herein, we report a brief overview of the care of penetrating cardiac wounds, illustrating also the birth of cardiac surgery and how dogma in medicine should be criticized.

2 | FROM MYSTICISM TO CRITICISM

Heart wounds have been described for centuries. *Iliad* and *Odyssey*, by Homer, contain references to weapons implanted in the chest, mainly by spearing. Moreover, 34 cases of thorax-torso trauma are reported in the epics.¹ This legendary story even described the cardiac impulse transmitted through a spear that hurt the chest of Alkathoos. Some historians and researchers suggested that Homer himself might have been a military surgeon to provide so precise descriptions of the treatment of

battle wounds.² According to Aristotle (3rd century AD), the heart was a vital organ that may not withstand major affection. Moreover, Galen (2nd century AD), who had to manage severe injuries in warriors and gladiators reported that penetrating cardiac wounds were fatal in all cases. One should keep in mind that Galen kept a scornful look about surgery and described wrongly, the human heart anatomy and function. As he embarked on monotheism and Catholicism, his point of view was carved in stone for centuries. Ambroise Paré (16th century), who started his career as a barber-surgeon and is considered for many as the father of surgery, described later the prognosis of cardiac wounds and reported the autopsy of a man stabbed to the heart at Turin, Italy.³ At that time, and according to Fabricius, it appeared obvious that "if the heart is wounded the affair is desperate and it is, therefore, unnecessary to attempt any treatment".³ If Francesco Romero is considered by some authors to be the first surgeon having drained a pericardial effusion in 1801, Baron Dominique Jean Larrey also reported in 1810 his first pericardiotomy on a soldier who tried to commit suicide by stabbing himself in the chest.^{4,5} Although this Surgeon-in-Chief of the Grand Army did not suture any heart wound, he drained the pericardium space and described a surgical approach to do so, through the base of the xiphoid (still known as the Larrey point).

Despite the beginning of few animal experiments by Block in 1882, contemporary opinions on the heart surgery at that time were set up as dogma; and in 1883, the well-known Austrian surgeon, Theodor Billroth, even declared: "the surgeon who should attempt to



FIGURE 1 Knife in the cardiac area

suture a wound of the heart would lose the respect of his colleagues.”⁵ Moreover, in 1896, the British surgeon Stephen Paget established a fatalistic statement: “Surgery of the heart has probably reached limits set by nature to all surgery. No new method and no new discovery can overcome the natural difficulties that attend a wound of the heart.”⁶

3 | FIRST SUTURE OF A CARDIAC STAB WOUND

With this overall pessimism about heart surgery in mind, the first reported suture of a myocardial laceration was performed by a Norwegian surgeon, Axel Cappelen in 1895.⁷ A 24-year-old male had a stab wound to the left chest, on whom Axel performed a left thoracotomy of the fourth intercostal space and found a 2-cm laceration of the left ventricle and sutured it using katgut material. The operation was performed under chloroform anesthesia, but unfortunately, the patient died due to postoperative sepsis, 3 days later. As this first suture on a human beating heart ended in death, this historical operation had been overshadowed by the successful suturing of a right ventricle injury by a German surgeon, Ludwig Rehn, a few months later. In September 1896, in Frankfurt, a 22-year-old gardener was stabbed in the chest. Rehn, who was a self-taught surgeon without any prior experience with heart surgery, realized a left thoracotomy and observed a wound measuring approximately 1.5 cm in the middle of the right ventricle. He sutured the heart wound, applying ordinary surgical principles. The patient recovered and Rehn reported, 6 months later, this procedure at the German Society of Surgery.

One year later (1897), the first suture of the left ventricle was performed in Rome by the surgeon Antonio Parrozzani; and in 1907 Rehn reported 124 cases of surgical treatment of heart wounds and a 60% mortality rates,³ which was still much less than the conservative and nonoperative treatment (see Figure 1 and Supporting Information Video).

4 | THE ROLE OF STERNOTOMY AND WORLD WAR II IN THE TREATMENT OF CARDIAC WOUND

All these pioneers gained surgical entry into the chest through an intercostal approach, with or without rib resection. Herbert Nelson

Milton was a British medical officer at the Kasr El Aini Hospital in Cairo who had to operate on many patients requiring emergent thoracic surgery. In 1897, he reported a direct approach to the mediastinum as an “anterior median thoracic incision,” which is, in fact, a median sternotomy.⁸ He declared: “So easy is this incision of execution and so considerable is the power of exploration thereby obtained that one is almost induced to hope that future experience may justify the application to it of the term normal thoracic incision.” This approach nowadays is the gold standard for cardiac surgeons not only for cardiopulmonary bypass surgery but also to safely and quickly manage a cardiac stab wound.

Medical and surgical knowledge, in particular, have always benefited from wars; and World War II served an opportunity to observe shell fragments and other missiles in human hearts. Blalock and Ravitch⁹ published in 1943 the use of pericardiocentesis to deal with cardiac wounds in soldiers, but it is truly Dwight Harken who revolutionized this dreadful management. Harken was called to duty as a consultant thoracic surgeon and he reported in 1946 an impressive experience that clearly inspired surgeons regarding the development of cardiac surgery.¹⁰ Indeed, over a 10-month period, Harken removed 78 missiles that were within or in proximity to the great vessels; he extracted 56 foreign bodies from the heart, 13 of them from the cardiac cavities. He operated on 134 patients with chest and cardiac wounds without a single death. One should keep in mind that cardiopulmonary bypass did not exist at that time and Harken's work helped to change the field of cardiac surgery.

Since World War II many improvements in the management of penetrating cardiac injuries have been reported which include the use of echocardiography, emergency department thoracotomy, pericardial drainage, fluid management, and use of vasoactive drugs for the restoration of blood pressure. Despite these evident improvements, even today, the outcome of a penetrating cardiac injury remains poor in Western countries' urban trauma centers.

5 | CONCLUSION

This brief history of cardiac wounds illustrates how it is important to keep an open mind in medicine. The next generation of cardiologists, anesthesiologists, and cardiac surgeons will have new challenges to

overcome that may appear impossible to cure at that point of time. However, what seems impossible today may become a standard routine of care in the future. Fear and criticism about new procedures are unavoidable but should represent for pioneers a boundary to break down.

ORCID

Erwan Flécher  <http://orcid.org/0000-0003-1379-0438>

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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