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Ann Thorac Surg 2007;83:2246-2247
DOI: 10.1016/j.athoracsur.2006.07.077

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New Method for Sternal Closure After Vacuum-Assisted Therapy in Deep Sternal Infections After Cardiac Surgery

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The treatment of nonhealing and infected sternotomies after cardiac surgery is a challenging task with increased rates of mortality and morbidity, as well as high costs. A local vacuum therapy (ie, the vacuum-assisted closure system) permits the treatment of deep sternal infections due to continuous aspiration and a sealed dressing that stimulates granulation tissue formation. Aggressive vacuum-assisted closure treatment of the sternum in postoperative deep wound infection enhances sternal preservation and the speed of potential rewiring. After some weeks of vacuum-assisted closure therapy, a complete preparation of the substernal structures is necessary. In this context, laceration of the right ventricle is a rare but life-threatening complication. We describe a new technique for sternal closure after vacuum-assisted wound treatment using Nitinol clips (Praesidia, Bologna, Italy), which can prevent these severe complications. Without any preparation of the substernal tissue the clips can be inserted in the parasternal space with consecutive proper stabilization of the sternum. This new method represents an easy, low-cost and complication-free procedure.


Since the introduction of the median sternotomy for open-heart surgery, wound infections have represented a serious and potentially life-threatening complication. The incidence varies between 1% and 5% with substantial morbidity and mortality rates [1]. Therapeutic strategies for such infections include closed mediastinal antibiotic irrigation, the primary use of pectoralis muscle flaps, aggressive surgical debridement, delayed closure, and plastic reconstruction with muscle and omental flaps [1–3].

In 1997 the vacuum-assisted closure (VAC) system was first introduced for chronic wound infections. The idea behind this therapy was to apply a uniform and negative pressure to the infected wound, resulting in arteriolar dilatation and initiating granulation tissue proliferation [4]. Since that time, application of the VAC system in cardiac surgery has steadily increased [5–8]. After healing, wounds are closed either by reconstructive surgery with a pectoralis muscle flap or in the majority of more recent cases, the wounds are closed by primary wound closure with rewiring of the sternum. For rewiring, the substernal structures (ie, right ventricle and bypass grafts) must be prepared. To prevent injury of these important structures, Nitinol clips (Praesidia, Bologna, Italy) have been recently used for sternal closure without the need to prepare the substernal structures. Products made of nitinol (nickel-titanium) alloys have been successfully used in many surgical applications since the 1970s (ie, maxillo-facial, plastic surgery, orthopedics, traumatology, neurosurgery, urology, and angiology). The application of thermic reaction devices made of nitinol with shape memory effect represents an alternative to traditional devices made of special steel or titanium.

**Technique**

First, the VAC system is carefully removed. Then the upper side of the sternum is exposed as far as the ribcage. With a special instrument (Fig 1), the width of the sternum is measured at each level (manubrium, mesosternum). The Nitinol clips (Praesidia; Fig 2) are available from 20 mm to 40 mm in size. For the sternum, closure clips are selected with a diameter of 2.5 mm or smaller than that measured to ensure perfect stability. The selected clip is then immersed in cold water (\(-10^\circ\)C). Contact with the cold water causes the arms of the Nitinol clip to open, enabling the clip to be positioned easily around the sternum. Four to five Nitinol clips are usually sufficient to achieve good stability (Fig 3). Contact with the tissue at body temperature causes the arms of the clip to close tightly around the sternum. Further wound closure is then performed in the customary manner.

**Comment**

The use of Nitinol clips (Praesidia) for sternal closure after what may be long-term VAC therapy relieves the surgeon of a necessity to prepare all the substernal...
structures. This in turn reduces the risk of important structures such as the right ventricle or a bypass graft from being damaged in cases of potentially extreme adhesion. The method described here is easy to perform; the operation duration is shorter than with conventional sternum closure using sternal wires. In addition, this technique is extremely inexpensive. In between we have performed sternal closure after VAC therapy using Nitinol clips (Praesidia) in 16 patients (age range, 59–77 yrs; mean age, 68 yrs). All patients had an increased risk profile for sternal infections (ie, obesity, diabetes mellitus, and so forth). In all patients we could achieve sufficient sternum stability and uncomplicated wound healing. Nitinol clips (Praesidia) could also be used to stabilize the sternum in patients with a pseudarthrosis some considerable time after sternum closure.

References


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