Overview and Management of Sternal Wound Infection

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ABSTRACT

Sternal wound infection is a life-threatening complication after cardiac surgery associated with high morbidity and mortality. Past treatment options have included closed suction and continuous irrigation. Current paradigms in the management of sternal wound infection include surgical debridement, vacuum-assisted closure therapy, flap coverage, and sternal plating. We provide a general overview of sternal wound infection and treatment options for the plastic surgeon.

KEYWORDS: Sternal wound infection, treatment, flap, VAC, sternal plating

Deep sternal wound infection (DSWI), also termed *mediastinitis*, is a life-threatening complication after median sternotomy with an incidence of 1 to 5%.¹ Patients with DSWI die at a rate that is twice that of those without mediastinitis.² The associated mortality rate in the literature ranges from 10 to 47%.^{3,4} Risk factors for the development of DSWIs after median sternotomy include diabetes, obesity, chronic obstructive pulmonary disease, osteoporosis, tobacco use, reoperation, prolonged intensive care unit stays, and use of assist devices.³ Patients with sternal wound complications accumulate an average of 20 additional hospital days and incur an estimated 2.8 times the cost of that for patients with uncomplicated postoperative courses.⁴ One study suggested an additional cost of \$500,000 per incident of poststernotomy mediastinitis.⁵

It is important to distinguish DSWIs from superficial sternal wound infections (SSWIs). An SSWI involves the skin, subcutaneous tissue, and pectoralis fascia only. The incidence of SSWIs is 0.5 to 8% with an associated morbidity and mortality rate ranging from 0.5 to 9%.^{6,7} The diagnosis may be made clinically by the presence of erythema, drainage, fever,

and sternal instability but is often occult with a low-grade fever as its only presentation. SSWIs are often completely eradicated with intravenous antibiotics and local wound care if necessary without long-term sequelae.

As defined by the Centers for Disease Control and Prevention, DSWIs require the presence of one of the following criteria: (1) an organism isolated from culture of mediastinal tissue or fluid; (2) evidence of mediastinitis seen during operation; or (3) presence of either chest pain, sternal instability, or fever ($> 38^{\circ}\text{C}$), and either purulent drainage from the mediastinum, isolation of an organism present in a blood culture, or culture of the mediastinal area.⁸ These patients require a much more aggressive treatment regimen consisting of early surgical debridement with subsequent autologous tissue coverage and long-term intravenous antibiotics.

The Pairolero classification of infected median sternotomies divides wounds into three types based on duration and clinical findings.⁹ Type I infections occur within the first week after sternotomy and typically have serosanguineous drainage but no cellulitis, osteomyelitis,

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or costochondritis. They are typically treated with antibiotics and a single-stage operation. The majority of cases are type II infections, which occur during the second to fourth weeks after sternotomy and usually involve purulent drainage, cellulitis, and mediastinal suppuration. Costochondritis is rare, but osteomyelitis is frequent. Treatment begins with exploration and debridement of all necrotic tissues with removal of all foreign materials and exposed cartilage. Suction drains and muscle transposition are used to close the wound when the mediastinum is soft and pliable. Type III infections occur months to years after sternotomy and typically involve chronic draining sinus tracts and localized cellulitis. Although mediastinitis is rare, osteomyelitis, costochondritis, and/or retained foreign bodies are often present. These chronic wounds are packed open and treated with frequent dressing changes and repeated debridement as indicated. When the wound appears clean, it is closed with methods similar to those used in advanced type II infections.

Patients undergoing a median sternotomy for coronary artery bypass grafting have the highest rate of sternal wound infections compared with those for other surgeries. Additional surgical risk factors have been reported and include increased duration of surgery and perfusion time, use of an intra-aortic balloon pump, postoperative bleeding, reoperations, sternal rewiring, extensive electrocautery, shaving with razors, administration of prophylactic antibiotics > 60 minutes prior to incision, improper antibiotic dose adjustments and inadequate skin preparation in obese patients, and the use of bone wax.^{10–16} Table 1 presents independent risk factors for mediastinitis observed in previous studies.

There has been much focus on internal mammary artery harvesting and its influence on sternal wound infections. The conventional “pedicled” harvest dissects the artery away from the sternum with its accompanying veins, fascia, adipose tissue, and lymphatics generating a pedicled graft that has been shown to decrease sternal blood flow by up to 90%.¹⁷ The “skeletonized” technique requires that the internal mammary artery (IMA) be dissected free of all surrounding tissue, solely yielding the artery, and has been shown to maintain better sternal blood supply. This has brought some authors to the conclusion that in the presence of any risk factor or the need for bilateral IMA grafts, the skeletonized technique of harvesting IMA grafts should be performed.

Standard protocols have been emphasized to help reduce the incidence of sternal wound infections and include careful and atraumatic sternotomy, strict adherence to aseptic technique, attention to hemostasis, avoidance of dead space, consideration of each patient’s risk factors, prophylactic use of intranasal antibiotics to prevent methicillin-resistant *Staphylococcus aureus* (MRSA) colonization, and the application

of Robicsek wires or sternal fixation in high-risk patients.^{18,19}

The most commonly isolated pathogen from wound cultures taken at the first surgical revision is *Staphylococcus aureus* followed by coagulase-negative *Staphylococcus* (CoNS).²⁰ Other pathogens found associated with DSWI are *Propionibacterium*, *Acinetobacter*, *Enterobacter cloacae*, *Escherichia coli*, and *Klebsiella*. There is a subset of sternal wound patients that never grow a pathogen and are deemed to have noninfectious sternal dehiscence. Olbrecht et al reviewed 12,380 median sternotomy cases from 1994 to 2004 and found 48 (0.39%) patients with this condition.²¹ The majority of these patients presented with pain or instability of the sternum, and others presented with drainage, nonunion, or were completely asymptomatic.

Gårdlund et al postulated that certain predisposing factors seem to be associated with certain pathogens and stratified DSWI into three forms.²² CoNS is the dominant species in the first type in which dehiscence is associated with obesity and COPD. In the second form, *S. aureus* is predominant and is not associated with sternal instability or obesity, but instead is associated with perioperative or nasopharyngeal contamination and often presents with bacteremia. The third form involves gram-negative DSWI, most commonly *E. coli*, *Klebsiella*, or *Enterobacter* and is associated with bacterial spread from other sites. Table 2 presents culture-verified poststernotomy bacterial strains collected from vacuum-assisted closure or standard cultures.

DIAGNOSIS

The diagnosis of DSWI is clinical in nature. Fever and leukocytosis along with sternal wound dehiscence suggests DSWI. Sternal nonunion may be evident by a positive sternal click on exam. Imaging support mainly consists of computed tomography (CT) of the chest, which assists in evaluating the depth of dehiscence. Gur et al evaluated more than 200 patients with sternal wound infections and found CT to be highly sensitive in aiding diagnosis of sternal wound infections.²³ Nuclear imaging may be of value in the early stages of DSWI.²⁴

MEDICAL TREATMENT

Prophylactic perioperative antibiotic therapy and intranasal prophylaxis with mupirocin has also been shown to be effective against reducing the incidence of postoperative sternal wound infection.¹⁸ In the face of clinical evidence of DSWI, empiric antibiotic therapy is initiated to include broad coverage against methicillin-resistant gram-positive, gram-negative, and anaerobic organisms. Culture-directed therapy should be

Table 1 Independent Risk Factors for Mediastinitis Observed in Previous Studies

Risk Factor	Odds Ratio	Mediastinitis Score AHA/ACC (Eagle and Guyton et al)	Study
Male gender	2.2 NA		Borger et al (1998) ¹² Demmy et al (1990)
Obesity/severe obesity	6.49 1.27 2.67 3.59 3.8 2.65 3.46	2.5/3.5	Abboud et al (2004) Bitkover et al (1998) The Parisian Mediastinitis Group (1996) Milano et al (1995) Nagachinta et al (1987) Ridderstolpe et al (2001) ⁷ Sjögren et al (2005)
Diabetes mellitus	5.82 2.6 5.0 3.24 2.6	1.5	Ridderstolpe et al (2001) ⁷ Borger et al (1998) ¹² Lu et al (2003) ¹¹ Sjögren et al (2005) Nagachinta et al (1987)
Smoking	3.27 1.8 2.41		Abboud et al (2004) Nagachinta et al (1987) Ridderstolpe et al (2001) ⁷
COPD	NA	3.5	Demmy et al (1990)
Heart failure/NYHA class 3 to 4	3.36 1.33		Ridderstolpe et al (2001) ⁷ Milano et al (1995)
Low LVEF	3.02	2	Sjögren et al (2005)
Renal failure	6.93	2.5	Sjögren et al (2005)
Peripheral vascular disease	3.7 2.11		Lu et al (2003) ¹¹ Ridderstolpe et al (2001) ⁷
Coronary disease/coronary surgery	2.67 6.85 3.2		The Parisian Mediastinitis Group (1996) Sjögren et al (2005) Muñoz et al (1997)
Use of BIMA	3.2 4.23		Borger et al (1998) ¹² Ridderstolpe et al (2001) ⁷
Length of surgery	1.0		Milano et al (1995)
Re-do surgery	2.2		Milano et al (1995)
Re-exploration	9.2 NA 3.3		Muñoz et al (1997) Ottino et al (1987) The Parisian Mediastinitis Group (1996)
Transfusion	NA		Ottino et al (1987)
Prolonged mechanical ventilation	1.04 1.004		Lu et al (2003) ¹¹ Ridderstolpe et al (2001) ⁷
Prolonged use of inotropic drugs	2.37 3.5		The Parisian Mediastinitis Group (1996) Muñoz et al (1997)
ICU stay > 2 days	4.5		Abboud et al (2002)

Abbreviations: NA, not available; COPD, chronic obstructive pulmonary disease; NYHA, New York Heart Association; LVEF, left ventricular ejection fraction; BIMA, bilateral internal mammary artery; ICU, intensive care unit.

Source: Sjögren J, Malmjö M, Gustafsson R, Ingemansson R. Poststernotomy mediastinitis: a review of conventional surgical treatment, vacuum-assisted closure therapy and presentation of the Lund University Hospital mediastinitis algorithm. *Eur J Cardiothorac Surg* 2006;30:898–905.

initiated as soon as microbiological analysis is available. Blood, urine, and sputum cultures should also be obtained. Systemic antibiotics are typically given for 6 weeks. Infectious disease consultation is usually obtained for further guidance. Antifungal therapy is often administered in the absence of clinical improvement on antibiotics.

SURGICAL TREATMENT

There is a multitude of current treatment options available for sternal wound closure. These include, but are not limited to, closed suction antibiotic catheter irrigation systems, vacuum-assisted closure, the omental transposition, the unilateral pectoralis major muscle “turnover” flap, the unipedicle pectoralis major muscle rotation

Table 2 Culture-Verified Poststernotomy Bacterial Strains Collected from VAC or Standard Cultures: Culture-Verified Poststernotomy Mediastinitis at Lund University Hospital, 1994 to 2003

Bacterial Strains	VAC Therapy		Conventional Treatment	
	<i>n</i>	Percentage (%)*	<i>n</i>	Percentage (%)*
CoNS	34	56	27	68
<i>Staphylococcus aureus</i>	8	13	2	5
<i>Enterobacter cloacae</i>	4	7	1	3
<i>Klebsiella oxytoca</i>	3	5	0	0
<i>Propionibacterium acnes</i>	2	3	0	0
<i>Escherichia coli</i>	1	2	0	0
<i>Bacteroides fragilis</i>	1	2	0	0
<i>Klebsiella pneumoniae</i>	1	2	2	5
CoNS + <i>S. aureus</i>	3	5	2	5
CoNS + <i>E. coli</i>	2	3	0	0
CoNS + <i>Proteus mirabilis</i>	1	2	1	3
CoNS + <i>Pseudomonas aeruginosa</i>	1	2	0	0
CoNS + <i>Enterococcus faecalis</i>	0	0	3	8
CoNS + <i>Enterobacter aerogenes</i>	0	0	1	3
<i>S. aureus</i> + <i>Citrobacter freundii</i>	0	0	1	3

*The sum of the percentages exceeds 100% due to rounding.

Source: Sjögren J, Malmström M, Gustafsson R, Ingemansson R. Poststernotomy mediastinitis: a review of conventional surgical treatment, vacuum-assisted closure therapy and presentation of the Lund University Hospital mediastinitis algorithm. Eur J Cardiothorac Surg 2006; 30(6):898–905.

advancement flap, the rectus abdominus muscle flap, bilateral myocutaneous pectoralis major muscle flaps, the latissimus dorsi muscle flap, the microsurgical free flap, and various combinations of the above. Treatment of any DSWI consists of early wound exploration. Sternal fixation with sternal plating systems is gaining popularity as part of many treatment regimens.

Closed Suction and Irrigation

Continuous irrigation and drainage in a closed sternum replaced dressing changes when it was developed in 1963.²⁵ This notion of closing the sternum was revolutionary in that it eradicated the thoracic instability associated with secondary healing and precluded the need for prolonged intubation and immobilization. Bryant et al advocated the addition of antibiotics to continuous irrigation.²⁶ Grossi et al reviewed a series of 77 infected patients treated by closed suction antibiotic catheter irrigation.²⁷ When done within 3 weeks of sternotomy, a 90% wound closure success rate was shown with an overall mortality rate of 22%. Closed drainage without irrigation using Redon catheters after sternal debridement was later advocated. This was achieved by placing numerous small catheters into a negatively pressurized bottle at the time of sternal debridement^{27–29} and was first described in the orthopedic literature as a treatment for osteomyelitis. Durandy et al described Redon catheter use in 10 patients and reported successful closure rates, describing it as a less aggressive and simpler treatment modality.³⁰ Redon catheter suction treatment reduced

30-day mortality and failure rates significantly compared with those for treatment with closed continuous irrigation. Kirsch et al also described Redon catheter primary closed drainage as a beneficial therapy for many patients with poststernotomy mediastinitis, but cautioned that patients with MRSA or recurrent infection may benefit from more aggressive initial debridement and approach.³¹ It is clear, however, that regardless of the type of closed suction drainage applied, the benefits are evident in the first 2 weeks of clinical signs of mediastinitis. More delayed presentation or long-standing infection will not be amenable to closed suction drainage.

Role of Vacuum-Assisted Closure

The use of vacuum-assisted closure (VAC) for tissue repair was described in 1997 by Morykwas et al.³² Two years later, data became available regarding the use of VAC in poststernotomy mediastinitis.³³ VAC therapy has been shown to increase peristernal blood flow by increasing arteriole dilation even in the face of internal mammary artery harvest and to reduce bacterial loads, leading to enhanced granulation tissue formation.^{32,34} At the same time, VAC assists in facilitating wound edge approximation, thereby stabilizing the chest.^{35,36} In fact, VAC therapy has been shown to have positive effects on respiratory function and hemodynamics and has been used in the management of open chests.^{36,37} VAC therapy not only assists with definitive closure but can also act as a bridge to reconstruction such that cardiac surgeons can easily place a VAC on a patient

seen in follow-up who is found to have a sternal dehiscence. This can begin the treatment process while the patient is referred to a plastic surgeon. In addition, VAC therapy may be the only treatment option for patients who are too critical to withstand the stress of operative debridement and reconstructive surgery. Several reports to date report excellent outcomes with the use of VAC in sternal wound infections. Tang et al described complete sternal wound healing with VAC use.³⁸ In fact, Cacyi et al showed an association between the use of VAC therapy and improved survival in patients with DSWIs.³⁹ This finding was further supported by Baillet et al, who reported on a 15-year review of nearly 25,000 sternotomies, noting a significant difference in early and midterm survival.⁴⁰ Figure 1 depicts an increase in the use of VAC treatment over the years of their study. VAC treatment has even been described as an alternative to surgical treatment.⁴¹ Gdalevitch et al found that for patients with negative blood cultures, wound depth less than 4 cm, and a low degree of bony exposure and sternal instability, VAC therapy alone is likely to be successful.⁴² That is, bacteremia, wound depth greater than 4 cm, and bony exposure and sternal instability are strong predictors of VAC failure, and definitive surgical treatment should be sought in lieu of single-therapy VAC treatment.

Complications with VAC use include a possible increased risk of bleeding and potential damage to underlying tissues, in particular the rare complication of right ventricular rupture.⁴³ The duration of VAC therapy has been an issue of debate. Whereas VAC therapy is clearly helpful in the management of the majority of sternal wounds, recent reports suggest that prolonged VAC use for more than 3 weeks can be detrimental. This is supported by the Lund University hospital algorithm, which advocates short-term VAC use followed by early direct sternal closure.⁴⁴ Bapat et al postulate that prolonged use of the VAC system may

cause recurrent sternal breakdowns, infection, and osteomyelitis due to the continuous tissue suction and also suggest judicious short-term use of VAC as a bridge to definite treatment.⁴⁵ Grauhan et al recently published a case report of *Staphylococcus epidermidis*-associated erosion of the ascending aorta during VAC treatment for mediastinitis. They suggest that it was perhaps not mechanical damage but rather pathogen incorporation into rapid turnover granulation tissue that contributed to this rare event.⁴⁶

Flap Coverage

Flap reconstruction is considered standard therapy for DSWIs since described by Jurkiewicz and colleagues in 1980.⁴⁷ Patients with DSWI who are referred for plastic surgery consultation have a statistically significant decrease in ventilator dependence, placement of a tracheotomy, development of stage III/IV pressure sores, major wound dehiscence, length of hospital stay, and mortality compared with patients who are initially managed conservatively by cardiac surgeons.⁴⁸ Brant and Alvarez compared a group of patients managed with debridement followed by muscle or omental flap reconstruction to a similar group of patients treated at the same institution by their cardiovascular surgeon with traditional debridement, rewiring, and closed drainage. They demonstrated a 22% rate of major complications and a 0% mortality rate in their group treated within 4 days compared with a 92% rate of major complications and a 33% mortality rate in the traditionally treated.⁴⁹

Pedicled muscle flaps promote early wound closure and reduce mortality.^{47,50,51} In a review of 211 sternal infections treated with muscle flaps, successful wound closure occurred in 95% of patients with a mortality rate of 5.7%.⁵² The omental flap is also a useful reconstructive option because it is able to conform to the deepest recesses of the sternal wound and carries immunologic properties with a small series showing superiority versus the pectoralis flap in preventing sepsis-related morbidities.⁵² The emergence of laparoscopic omental harvest has placed new attention on omental flap use in sternal wound defects.⁵³ Complications are related to the laparotomy and the potential for infectious spread from one cavity to the other, as well as a greater risk for abdominal hernia formation. As such, the omentum is often a secondary reconstructive option after pectoralis or rectus flaps have failed or are not available. A recent report by Stump et al suggests that diabetic patients with DSWI treated with omental transposition showed a decreased need for flap revision compared with that for pectoralis muscle flap.⁵⁴

Since first reported by Jurkiewicz and colleagues in 1980, muscle flaps have become the cornerstone of treatment for sternal reconstruction. Jones et al described a >20-year experience at Emory University Hospital

Figure 1 Incidence of VAC treatment and DSWIs from 2002 to 2007. Note the inverse correlation between the increased use of VAC treatment and the incidence of DSWI.

from 1975 to 1996, in which 409 patients underwent sternal reconstruction with various regional flaps.⁴⁷ Popularity of the pectoralis flap for primary reconstruction increased from 57.2% in the first 10 years to 76.6% in the last 10 years, which has been echoed in many other reports. Combinations of the turnover pectoralis major muscle flap based on IMA perforators, the unipedicled pectoralis major muscle rotational advancement flap based on the thoracoacromial artery, and the myocutaneous pectoralis major muscle flap have all been used for sternal reconstruction with excellent results.

The rectus abdominus flap is pedicled on the superior epigastric artery and is advocated based on its ease of dissection and its wide arc of rotation, which allows it to reach the sternal notch as well as the most common site of breakdown, the lower third of the sternal wound. Although hernia formation or protrusion is a concern, Davison et al were able to diminish significantly this complication from a reported 50% in some studies to 2% in their series by leaving the rectus fascia in place and closing in two layers.⁵⁵ When comparing rectus abdominus flaps alone and the modified pectoralis major flap with anterior rectus sheath extension, the rectus group showed a statistically significant improvement in preventing dehiscence of the inferior third of the sternum. Microvascular surgery is rarely used in sternal wound management.

The majority of bypass patients have had at least the left and on occasion the right IMA harvested, limiting the use of the turnover pectoralis major muscle flap to one or neither side. However, in cases where the IMA is preserved, this operation is performed by dividing the muscle's humeral insertion and folding the lateral portion of the muscle into the mediastinum, while maintaining its vascular supply by means of perforators from the IMA and anterior intercostals arteries. This maneuver may result in an abnormally raised contour deformity of the anterior chest wall, causing tension on the skin closure. Many use a combination of the turnover pectoralis flap on the side in which the IMA has not been harvested and an unipedicled rotational advancement flap on the ipsilateral side.

The workhorse flap in sternal wound reconstruction is the pedicled pectoralis major muscle flap based on the thoracoacromial artery. There is a relatively avascular plane both superficial and deep to the pectoralis major muscles. By detaching the muscle from its sternal, rib, humeral, and medial clavicular attachments and separating it from the clavicular head of the deltoid, it can usually be extended to the level of the xiphoid. Some advocate the lateral dissection be done only until the flaps reach midline without significant tension. Back-cutting the superior medial segment of the pectoralis muscle for a distance of 4 to 6 cm maintains its blood supply and allows for more caudal coverage. The thoraco-acromial vascular axis, pectoralis minor muscle, and

innervations of the pectoralis major are left intact. After debridement and flap elevation, the wound is thoroughly cleansed with a pulse irrigator using 3 L of an antibiotic-containing solution. The pectoralis is then approximated with large sutures to the cephalad portion of the rectus sheath to help with support and full sternal coverage. Drains are typically placed in the axillary region (1), against the rib cage over the pectoralis minor (2), adjacent to the sternal defect (3), and subcutaneously (4). No drain is disturbed for 72 hours when drains 2 and 4 are typically removed. The remaining drains are left in place until volumes drop below 40 cc over 24 hours.

Jones et al had an overall complication rate of 18.8%.⁴⁷ Their most common complication was recurrent wound infections seen in 6.5% of cases, followed by hematoma (6.1%), wound dehiscence (6.1%), re-exploration for wound necrosis (5.9%), partial flap loss (3.8%), and abdominal hernia formation after rectus abdominus harvest (2.2%). Wound dehiscence, most common in the inferior portion of the wound, occurred most often in older patients with chronic obstructive airways disease and a history of smoking as well as in obese women with large pendulous breasts. Hematoma, though less frequent, almost always requires reoperation. Early reinstitution of anticoagulation is the most common cause, prompting their delay until 72 hours after reconstruction if medically permitted. By using aggressive drain management, the incidence of seroma has been reported as less than 2% with single muscle pedicled flaps and ~30% when bilateral. Ascherman et al were able to lower their overall seroma rate from 24.3 to 3.5% by simply increasing the mean number of days until final drain removal from 11 to 22.⁵⁶ Patel et al recently reviewed more than 8000 median sternotomies and found 131 cases of DSWI for an incidence of 1.5% and an overall mortality rate of 21%.⁵⁷ They specifically reviewed predictors of mortality after debridement and flap reconstruction and suggest that presternotomy end-stage renal disease, chronic obstructive lung disease, and mechanical ventilation may be predictors of perioperative mortality after sternal debridement and muscle flap coverage.

Rigid Sternal Fixation

DSWIs require debridement of the sternal bone itself and often adjacent costal cartilage. After debridement for DSWIs, Gottlieb et al found that many times the remaining bone is viable and vascularized, suggesting, then, that rigid fixation could be part of the reconstructive process.⁵⁸ Figure 2 shows an example of one type of sternal fixation. Sternal fixation offers sternal stability with the added benefit of patient comfort and accelerated healing as well as a decreased incidence of paradoxical chest-wall breathing and mediastinal hernia compared with flap coverage.⁵⁹ Early primate studies with sternal

Figure 2 Incidence of osteosynthesis from 2002 to 2007. Note the increase in the use of sternal fixation over time.

fixation showed earlier union from accelerated osseous healing.⁶⁰ Early studies showed significant advantages to using sternal fixation in cases of sternal dehiscence and DSWI, especially in high-risk patients.^{61–65} Figure 3 depicts an increase in the use of sternal fixation over time. Song et al extrapolated postoperative rigid fixation into its use in primary closure.⁶⁶ They showed that in high-risk patients, primary rigid fixation was associated with zero incidence of postoperative DSWIs compared with 14.8% in similar high-risk patients who underwent standard wire cerclage. Success in initial reports of sternal fixation had led some plastic surgeons to perform primary sternal plating in high-risk patients. Contraindications for the use of sternal plating include osteoporosis, concurrent active infection, extreme obesity, and significant bone loss. Complications with sternal plating have included recurrent sternal wound infections, commonly with MRSA, seroma, and hematoma.⁶⁷

CONCLUSION

Perioperative optimization has significantly decreased the incidence of sternal wound infection in the modern era of cardiac surgery. When sternal wound infections do occur, however, prompt recognition and treatment is

Figure 3 Example of type of sternal fixation. Note the precise alignment of the sternum with the assistance of the device.

paramount. Although treatment algorithms may vary among surgeons, thorough debridement and culture-directed antibiotics are standard. VAC is a useful bridge to definite closure. Muscle or omental flaps are often necessary to ensure successful closure. Sternal plating is beneficial in stabilizing the sternum in selected patients. Future innovations addressing DSWI will likely involve the interplay between tissue engineering and cellular-based therapy.

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