



## PREVENA Negative Pressure System to Prevent Postoperative Sternotomy Wound Complications: Case Series

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### Abstract

Prevention of surgical site infection in sternotomy wounds is the key to avoid serious outcomes in high-risk patients. This case series is reporting our center experience and outcome of the usage of “Prevena Plus” Negative Pressure System (NPS) in primary closed sternotomy wounds. NPS was applied on primary closed sternotomy wound for 7 days in high-risk patients for surgical site infection as a preventive measure to reduce post sternotomy wound infection and dehiscence.

**Categories:** Cardiac/Thoracic/Vascular Surgery

**Keywords:** Mediastinitis; Dehiscence; Wound infection; Sternotomy; Negative pressure system

### Introduction

Post-Sternotomy Mediastinitis (PSM) is a serious complication of post cardiac surgery with an incident rate ranging from 0.3% to 3.4%. Morbid obesity, poorly controlled diabetes mellitus, chronic renal failure, chronic smoking associated with chronic obstructive lung disease and bilateral mammary artery grafting are the main predisposing factors for post-sternotomy mediastinitis [1]. Post-sternotomy mediastinitis has a significant mortality reaching up to 19% and associated with prolonged hospital stay [1]. Management of sternal wound infection and mediastinitis depends on the severity and the extent of infection and it includes multiple debridement, Negative Pressure System (NPS) and grafting with muscle flap in some cases. A systematic review showed that prophylactic NPS resulted in a lower surgical site infection compared to the standard of care and regular wound dressing post primary wound closure [2]. The mechanism of action of NPS in mediastinitis is removal of exudate, enhanced granulation, and the perfusion in the infected sternum [3]. Prevena Plus incision management system (PREVENA™) is a continuous 125 mmHg negative pressure used in a closed surgical incision to remove fluid and prevent seroma formation for a better wound healing and hence prevention of wound infection. Prevena was applied to five patients who underwent open heart surgery and known to have uncontrolled diabetes mellitus and morbid obesity to assist the primary wound closure and prevent sternal wound infection. Currently consensus guidelines for post-sternotomy surgical wound infection prevention recommend preoperatively, intraoperative, and postoperative. hyperglycemic control. Also smoking cessation at least 30 days prior to cardiac surgery is known to reduce postoperative pulmonary complications and infection. Obesity is a well-known risk factor for PSM, and weight reduction prior to cardiac surgery can be challenging due to early timing of surgery and other patient’s related factors. Perioperative antibiotic prophylaxis is universally practiced reducing postoperative surgical wound infection [4]. NPS is considered as one of the modalities to prevent PSM in high-risk patient in emergency case where other risk factors cannot be modified.

### Case Presentation

Five post-cardiac surgery patients received Prevena therapy system between 2017 and 2021 at Sultan Qaboos University Hospital which is one of the largest tertiary and teaching hospital in Oman.

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**Table 1:** Baseline characteristics of cardiac surgical patient who received negative pressure system.

Case	Sex	Age (years)	Surgery	DM	HbA1c	BMI	NPS (intervention)	PSM (outcome)
1	Female	43	CABG	Yes	9.3	35.3	Yes	No
2	Male	61	MVR+AVR	No	6.4	43.2	Yes	No
3	Female	65	CABG	Yes	9.7	34.6	Yes	No
4	Female	63	CABG	Yes	6.3	32.5	Yes	No
5	Male	52	CABG	Yes	6.7	48.6	Yes	No

CABG: Coronary Artery Bypass Grafting; MVR: Mitral Valve Replacement; AVR: Aortic Valve Replacement; DM: Diabetes Mellitus; BMI: Body Mass Index; NPS: Negative Pressure System; PSM: Post-Surgical Mediastinitis

Four patients underwent Coronary Artery Bypass Graft (CABG) surgery, and one underwent aortic and mitral valves replacement (Table 1).

Prevena was applied in the primary closed wound in the operation theater. Postoperatively patients were monitored for signs of infection. All patients received prophylactic antibiotic therapy up to 48 h postoperatively as per protocol. None of the five patients who received Prevena plus systems develop surgical site infection up to 30 days of follow up after surgery. Prevena plus system was first applied in 2017 following a CABG surgery in a 61-years-old man who was known for hypertension, diabetes mellitus, morbid obesity (BMI: 48.67) and ischemic heart disease. After the chest incision was closed in layers, Prevena Plus system was applied in a clean primary closed sternal wound for all the five reported cases. The Prevena was removed on the 7<sup>th</sup> postoperative day. On the 7<sup>th</sup> day, the sternal wound appeared clean and dry, and no signs of infection were present. All five patients' follow up investigations showed normal inflammatory markers including White Cell Counts (WBC) and C-Reactive Protein (CRP). All five patients had a follow up in the cardiac surgery clinic one month after discharge and no signs of infection developed at the surgical site. Overall, Prevena plus system prevented post-sternotomy wound infection in all the five patients up to a month following cardiac surgery.

## Discussion

Surgical site infection of sternotomy wound in cardiac surgery can lead to a serious complications including sternal wound dehiscence and mediastinitis [5]. Post-sternotomy dehiscence classification is based on the affected tissue and vertical extension. The new classification describes four wound types, type I when skin and subcutaneous tissue is affected, type II when sternum and ribs are exposed, type III when part of sternal and ribs bone are lost and type IV when mediastinum is exposed [6]. Gårdlund et al. described three groups of pathogenic mechanisms of mediastinitis to guide the most appropriate and effective preventive interventions in patients undergoing cardiac surgery. The first group mediastinitis is associated with obesity and is typically caused by coagulase negative staphylococci. The second group is caused by contamination of mediastinal space preoperatively and it is commonly caused by *Staphylococcus aureus*. The last group of mediastinitis is often caused by spread of gram-negative bacteria form concomitant infections in other sites [7]. Most post-sternotomy mediastinitis requires surgical debridement, antibiotic therapy, and Negative Pressure Therapy (NPS) in some cases. Historically NPS has been used as a therapeutic intervention in surgical site infection, however current practice utilizes it on the clean primary closed wounds in high-risk patients as a preventive strategy. Brega et al. evaluated NPS in post-sternotomy

wound in comparison to gauze dressing and advanced (hydrocolloid and carboxymethyl cellulose) dressing over closed incision. There was a significantly lower rate of deep sternal complications in the NPS group [8]. Another retrospective study showed a lower incidence of post-sternotomy infection in patients who received NPS but there was no difference in hospital stay and mortality [9]. Prevena was found to be a cost-effective preventive measure and can potentially save an estimated cost of \$111,175. and \$7,981 in management in deep and superficial sternotomy infections respectively [10]. All the five cases discussed in our report had multiple risk factors for post-sternotomy wound complications. They have received perioperative antibiotic prophylaxis. The good outcome reported in these cases encourages expanding its use in this population of patients.

## Conclusion

Use of Negative Pressure Systems (NPS) as a pre-emptive intervention for preventing post-sternotomy wound complications, including mediastinitis, was found to be effective in all the five patients described in our case report. In cardiac surgical patients at high risk for post-sternotomy wound infection, NPS can be a cost effective and easy to use intervention to prevent surgical site infection.

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