Use of Perclot®, a plant-based polysaccharide hemostat, for Bleeding Control of the Sternum in High Risk Patients

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Abstract

Profuse bleeding from the sternal marrow after sternotomy is routinely controlled with bone wax. Unfortunately, bone wax should be avoided in high risk patients for nonunion of the sternum and infections. We present an alternative technique to control bleeding from the sternal bone marrow using a plant based polysaccharide hemostat (Perclot®, Starch Medical Inc.). While having satisfactory bleeding control, we did not observe any adverse events.

Introduction

Profuse bleeding from the sternal marrow after sternotomy is routinely controlled with bone wax, because it is effective, cheap and therefore favorable. Unfortunately, bone wax inhibits osseous fusion [1] and promotes infections [2]. Especially today, the increasing numbers of patients with high risk for sternal instability and wound healing complications following cardiac surgery demands improved concepts for bleeding control without the use of bone wax.

We present an alternative technique to control bleeding from the sternal bone marrow (Perclot®, Starch Medical Inc.).
**Technique**

Perclot™ consists of Absorbable Modified Polymers (AMP™). Perclot® is Starch Medical’s trademarked name for the dry, sterile, coralline-shaped particles manufactured from a purified plant-based polysaccharide using multiple, proprietary modification processes. The final product is a sterile, white powder that can be applied directly to a bleeding wound to help control blood loss. The powder does not contain any added proteins or biological agents. The hemostatic effect of the powder is produced by the rapid dehydration and subsequent hemoconcentration of blood in contact with the particles. The concentration of red blood cells, platelets, and serum proteins and accelerates the clotting cascade and produces a gelled matrix. Normal platelet activation and fibrin deposition within the congealed blood then produces a clot that limits further bleeding.

**Index case 1**

A 77-year-old male with instable angina was referred to our department for surgical revascularization. In addition the patient suffered from insulin dependent diabetes, chronic obstructive lung disease and obesity (body mass index = 36).
After median sternotomy severe osteoporosis was visible with excessive bleeding from the bone marrow. To control bleeding from this fragile sternum, electrocautery to the periostium was sparingly used and Perclot® was applied on each side of the sternum (Fig 1). In addition towels were wrapped around the absorbable hemostat for atraumatic management of the tissue, before the retractor opened the thorax, full heparinization (Active clotting Time > 300 sec) was initiated to implant the extracorporeal circulation and to perform off-pump coronary bypass (OPCAB): Three grafts – LITA to LAD, veins to circumflex artery and right coronary artery. After surgery, protamin was administered to antagonize heparin. No additional hemostatic agent was administered. Finally, the sternum was closed routinely with wires, before the skin was closed with intracutan suture.

The intra- and postoperative course of the patient was uneventful. The sternal spongiosa was intact and no sternal fracture was observed. No enhanced bleeding, infection or sternal wound healing complications occurred postoperatively.

**Results:**

A total of 21 patients had sternal bleeding control with Perclot®. No adverse event was observed. No allergic reaction. A sufficient control of bleeding was observed in 18 cases. No rethoracotomy because of
bleeding was necessary. No irritations of bypass-grafts were noted. Not one of the patient needed refixation because of instable sternum. One patient had a superficial wound infection, which needed cleaning and secondary wound-closure.

Discussion

Surgeons commonly recommend avoiding bone wax as much as possible for sternal bleeding control, especially in high-risk patients for infection or nonunion altogether [3]. Particularly in elderly patients and those with osteoporosis, bone wax is often even not effective. The spongiosa scaffold of the sternum will be destroyed during setting of bone wax and the marrow cavity may absorb large quantities of bone wax with still enhanced bleeding.

As shown in our cases, the absorbable Perclot® hemostat is a simple, safe and effective method for bleeding control in a high-risk patients. We had good or at least satisfactory intraoperative bleeding control in most cases. We observed no in-hospital mortality. No patient required a reoperation because of bleeding or instable sternum. None of the patients developed a deep sternal wound infection, but one had a superficial wound infection.
Other agents like fibrin sealant or microfibrillar collagen may as well have a good hemostatic effect, but they are cost-intensive.

Additionally, in our department, we are currently not using fibrin glue due to questionable correlation with increased morbidity.

We also do not recommend microfibrillar collagen. The small diameter of its needle-shaped structure might pass the filters of blood saving devices and enter in the patient's circulation. This might result in organ damage, e.g. lung or brain [6].

In conclusion, to avoid sternal bleeding complications with consecutive wound healing problems and mediastinitis, Perclot® can be temporarily administered safely and effectively.

**Other cases:**

**Index case 2**
Routine CABG with extracorporeal circulation – sternal use

**Index case 3**
Combined aortic valve and supraanular aortic replacement – Perclot® round suture line of native tissue and aortic Dacron-prosthesis

**Index case 4**
Lesion at left lung during heart surgery, air leakage and bleeding – Perclot® to lung
Index case 5

Excessive bleeding from beyond right pulmonary veins after epicardial ablation of the left atrium and pulmonary veins – Perclot® and suture

Index case 6

Excessive bleeding after small thoracic drain (pleura cath) left side - 3 packs of Perclot® and towels to compress bleeding from far behind

References


6. Robicsek F, Duncan GD, Born GVR, Wilkinson HA, Masters, TN, McClure M. Inherent dangers of simultaneous application of microfibrillar collagen

Other important publications for reference:

1. Fibrin glue instillation for profuse sternal bleeding.

Pasic M, Hetzer R.

2. Bleeding from the sternal marrow can be stopped using Vivostat patient-derived fibrin sealant.

Kjaergard HK, Trumbull HR.

Figures:

Figure 1: Perclot™ was applied to both sides of the sternotomy