Abstract

Cardiopulmonary bypass line sternal wrapping (SW) is a new approach to sternal care which avoids bone wax and offers mechanical protection and a shield from bacterial contamination, with beneficial effects on sternal healing. Since its introduction in February 2008, the technique has undergone some developments: it is possible to harvest internal thoracic arteries with SW in place and its haemostatic properties have improved.

Keywords: Bone wax; Sternal wound complications

1. Introduction

Cardiopulmonary bypass (CPB) line sternal wrapping (SW) is a technique to achieve early and satisfactory sternal haemostasis without using bone wax [1]. It also offers an unprecedented protection of the sternal edge.

2. Technique

SW creates, together with the sternal cut surface, a narrow waterproof tunnel which has only a small opening at each end. Only at the jugular end perfect tube-to-bone adherence is essential for haemostasis.

The original article described the use of two heavy-needle absorbable simple stitches to fix the tube at the sternum extremities per side. To seal this cranial exit better, here a tube transfixing (TT) stitch is preferred to the simple stitch. The TT stitch is first passed through the tube, from the outside to the inside, at 0.5 cm from its edge and 2–3 cm from its cranial extremity (Fig. 1), then cranially and laterally through the sternum like a first sternal wire, then again through the edge of the tube from the inside to the outside. This TT stitch is more effective in keeping the tube adherent to the bone because it has a smaller loop and takes less tube inside it. Besides there is no need to go too laterally on the manubrium avoiding any risk of injury to the lung or vascular structures adjacent to the jugular veins. When the TT stitch is being tied, pulling on its ends, like a shoehorn, spreads the tube edges and eases the placing of the sternum inside the tube. A TT stitch greatly reduces sliding of the tube and therefore, its placement must be precise. It is important that at the manubrium no sternal cut surface is left unwrapped; a short protrusion of the tube at the cranial end of the sternum will cause no harm.

SW hermetic properties are also useful for the prevention of sternal contamination from skin edge and environmental bacteria. With SW, the sternum remains exposed for only a few minutes after sternotomy and for another short-period at closure. For the remainder of the procedure it is sealed-off, except the xiphoid at times.

SW also offers mechanical support to the sternal edges. Once in place the CPB line changes its cross-section from circular to a C- or U-shaped which increases its stiffness and resistance to bending forces in a horizontal plane. Therefore, SW more evenly distributes spreading pressure over the sternum, limiting further bone injury.
Fig. 2. The Jostra mammary retractor is positioned with SW applied on both sternal edges. Detail of the inferior aspect of the left sternum. SW, sternal wrapping.

Applying another simple stitch to fix the SW in the middle of the sternum, usually through the third intercostal space, allows the use of a dedicated sternal retractor to harvest the internal thoracic arteries (ITAs). At the moment, this is possible with the Jostra retractor (Maquet Cardiopulmonary AG, Hirrlingen, Germany) (Fig. 2) but not with the Couëtil retractor (Delacroix – Chevalier, Paris, France). Usually SW does not impair the ITA view and contains blood dripping from the sternal edge, while harvesting it. If the sternum is extremely thin, before tying the stitches, one can rotate the SW slightly towards the outside, reducing the intrathoracic component that could obstacle ITA vision.

In summary, before incising the skin, once the two tubes are prepared, in each one we partially insert the needle of cranial TT stitch still leaving the thread in the container. This will facilitate their recognition as left or right and will make the set-up tidier. Then we put the tubes aside.

When we are ready to apply the SW, we start by inserting two simple stitches through the middle and the caudal extremity of the right sternum and we then secure each stitch ends with an artery forceps which is laid on the opposite side of the chest.

Next, we select the tube for the right sternum with the cranial TT stitch half through, complete the needle passage through the tube, then pass it through the right sternum, from inside to outside, and finally through the tube, from inside to outside. We then insert the tube inside the loops of the other two stitches previously placed.

The surgeon puts the tube to wrap the sternum beginning at the cranial end and while an assistant presses the tube in place, on either side of the stitch that is being tied, the surgeon ties them. Then the same procedure is repeated for the left sternum.

Since it is easier to insert these stitches through the sternum with the same direction of sternal wires placing, the left sternum TT stitch can be tricky. It is convenient to swing the tube clockwise on the horizontal plane, towards the patient head, as if the TT stitch were the pivot of a hinge. At this point it is easy to take the needle from inside the tube, pass it through the left manubrium from outside to inside and then through the tube from inside to outside. The tube is then swung back into position, passing between the two stitch ends.

SW haemostatic properties depend on the patients coagulation status before the administration of heparin and after that of protamine. The presence of liquid blood inside the SW at the end of the procedure is suggestive of deranged clotting or fibrinolysis which must be promptly corrected. SW should be removed at the very end of surgery, just before insertion of sternal wires. When the tubes are removed a thin clot is left behind, adherent to the sternum. These clots must not be removed and should be pressed in the sternum with a swab, while controlling for haemostasis at the inferior sternal edge and where the tube stitches where applied. Close monitoring of clotting status must continue in the first few postoperative hours.

3. Conclusion

With SW bone wax is omitted, sternal exposure to bacterial contamination and mechanical stress are reduced. All three factors may lower the incidence of sternal wound complications.

SW is a new concept as well as a do-it-yourself technique. All is needed are two segments on the CPB arterial line and three heavy needle absorbable sutures.

With what is readily available at the moment this is the best possible solution.

Reference