

Evaluation of Autologous Platelet Rich Plasma for Cardiac Surgery: Outcome Analysis of 2000 Patients

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Objective

The purpose of this study was to determine the incidence and cost of sternal wound complications in patients undergoing sternotomy for cardiac surgery procedures with and without the use of platelet-rich plasma (PRP).

Methods

Treatment Groups – Over a 7-year period (January 2005-2013), 2000 consecutive patients undergoing open cardiac operations requiring sternotomy were prospectively enrolled in this nonrandomized, single-center study. A total of 1000 consecutive patients received standard of care sternal closure and 1000 patients received standard of care sternal closure plus a topical PRP application applied to the sternum at the time of closure.

Sternal Closure – Sternotomies were performed midline with a sternal saw blade and closed with simple interrupted or figure-of-8 stainless steel wire. Wounds were closed with absorbable suture and dressed with Steri-Strips, gauze, and paper tape.

PRP Preparation/Application – In the treatment group receiving PRP, 52 mL of whole blood was drawn prior to surgery and mixed with 8 mL of anticoagulant citrate dextrose formula. The anticoagulated blood was processed for 15 minutes using a commercially available platelet separator system to create PRP. At the time of closure, prepared PRP was applied with calcium chloride and thrombin topically onto exposed sternal edges and subcutaneous tissue of the chest wound (6 mL PRP to 1 mL calcium/thrombin ratio).

Table 1. Platelet analysis pre and post concentration for growth factors

Mean ± SD	Baseline (60 mL)	PRP (mL)
PDGF AB (ng/mL)	8.4 ± 2.1	96.1 ± 22.5
PDGF AA (ng/mL)	2.1 ± 0.4	25.4 ± 3.9
PDGF BB (ng/mL)	5.9 ± 1.2	61.3 ± 11.6
TGF B1 (ng/mL)	46.4 ± 4.4	278.2 ± 38.4
VEGF (ng/mL)	76.3 ± 19.5	801 ± 266.1
bFGF (ng/mL)	15.6 ± 2.9	55.1 ± 9.6
EGF (ng/mL)	13.4 ± 2.1	187 ± 29.4

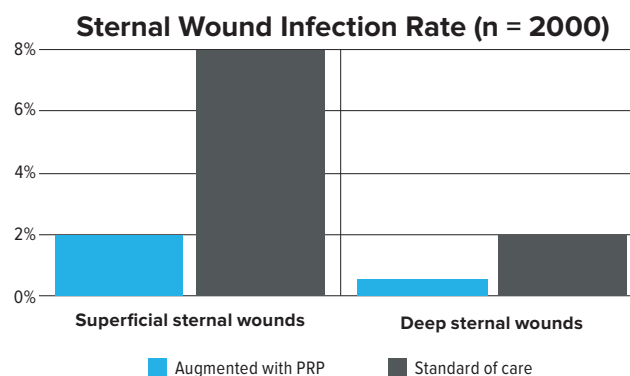
Cost Analysis – Costs evaluated include the actual cost of disposables used in the PRP procedure and costs associated with readmission (within 30 days of operation) and re-intervention. The 30 seconds to apply the PRP and the 30 seconds for the blood draw were not considered as part of this cost analysis. Costs were validated by the hospital operating room services director, vendor, and hospital finance department.

Outcomes – Outcomes evaluated were the incidence of deep and superficial sternal wound infections (DSWI and SWI), time to infection postsurgery, readmission rate within 30 days of operation, and the cost analysis per patient.

Results

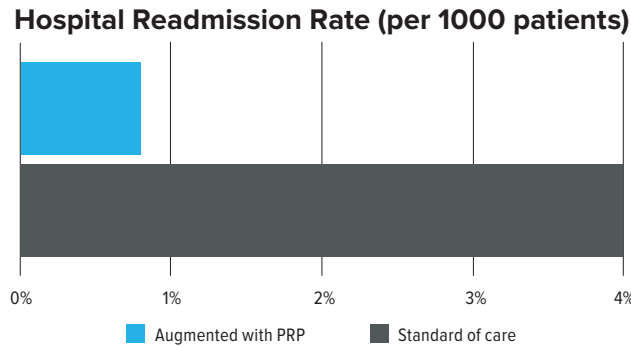
Infection – The use of PRP reduced the incidence of DSWI from 2.0% to 0.6% ($P = .009$) and superficial wound drainage from 8.0% to 2.0% ($P = .0001$) (Figure 1). Time to infection postsurgery demonstrated that all infections in the PRP group occurred within the first 2 months postsurgery while those in the control group occurred up to 4 months postsurgery.

Figure 1. Deep and superficial sternal wound infection rate in patients with and without the use of PRP for sternal closure.



Readmission Rate – The use of PRP reduced the readmission rate within 30 days of operation from 4.0% to 0.8% ($P= .0001$) (Figure 2).

Figure 2. Readmission rate per 1000 patients within 30 days of operation with and without the use of PRP for sternal closure.



Cost-Analysis – There was a significant reduction (>50%) in overall cost in the total management of deep and superficial wounds with the use of PRP (\$1,256,960 in the control group vs \$593,791 in the PRP group).

Mean cost of deep and superficial sternal wounds for a single patient is:

\$1,256,960 Standard of care $\xrightarrow{>50\% \text{ reduction}}$ **\$593,791** Augmented with PRP

Conclusion

The use of PRP within open cardiac operations requiring sternotomy decreases the incidence and costs associated with sternal wound complications.

Reference

1. Patel AN, Selzman CH, Kumpati GS, McKellar SH, Bull DA. Evaluation of autologous platelet rich plasma for cardiac surgery: outcome analysis of 2000 patients. *J Cardiothorac Surg.* 2016;11(1):62. doi:10.1186/s13019-016-0452-9