Study Limitations

The limitations of this study were linked to the limited number of cases and the retrospective analysis.

CONCLUSIONS

The results showed that the reduction in PLT depends on the type of sutureless bioprosthesis used. A significant but transient reduction in PLT is associated with the Sorin Perceval S valve without adverse outcomes, although larger prospective, randomized studies are mandatory.

References

1. Albacker TB. Thrombocytopenia associated with Perceval sutureless aortic valve replacement in elderly patients: a word of caution. *Heart Surg Forum*. 2015;18:E093-7.
2. Flameng W, Herregods MC, Hermans H, Van der Mieren G, Vercalsteren M, Poortmans G, et al. Effect of sutureless implantation of the Perceval S aortic valve bioprosthesis on intraoperative and early postoperative outcomes. *J Thorac Cardiovasc Surg*. 2011;142:1453-7.
3. Boldyrev AA. Molecular mechanisms of homocysteine toxicity. *Biochemistry*. 2009;74:589-98.
4. Hilker L, Wodny M, Ginesta M, Wollert HG, Eckel L. Differences in the recovery of platelet counts after biological aortic valve replacement. *Interact Cardiovasc Thorac Surg*. 2009;8:70-3.
5. Miceli A, Gilmanov D, Murzi M, Parri MS, Cerillo AG, Bevilacqua S, et al. Evaluation of platelet count after isolated biological aortic valve replacement with Freedom Solo bioprosthesis. *Eur J Cardiothorac Surg*. 2012;41:69-73.

EDITORIAL COMMENTARY

Tissue valve, nitinol stent, or storage solution? The mystery still goes on

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Thrombocytopenia is a frequent and transient event after cardiac surgery. It usually occurs between the second and third postoperative days and results in a reduction of platelet counts by 30% to 60% from baseline values.¹ In this setting, cardiopulmonary bypass plays an important role in inducing qualitative and quantitative platelet defects, resulting in platelet activation (structural and biochemical changes), formation of platelet conjugates, altered platelet force generation, and thrombocytopenia.¹ Furthermore, factors such as hemodilution, hypothermia, and the use of exogenous drugs, as well as the perioperative blood loss, may amplify these platelet changes. Finally, some studies have reported that some biologic valves might increase the risk of thrombocytopenia.²⁻⁴

In this issue of the *Journal*, Jiritano and colleagues⁵ have investigated whether the use of a specific sutureless bioprosthesis is linked to postoperative thrombocytopenia.

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Central Message

Thrombocytopenia is a frequent and multifactorial complication after cardiac surgery. A well-designed study is required to investigate on the role of sutureless valves in this complex phenomenon.

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Of 43 patients undergoing aortic valve replacement, 27 received the Intuity Edwards rapid-deployment valve

(Edwards Lifesciences Corporation, Irvine, Calif) and 16 received the sutureless Perceval S valve (LivaNova PLC, London, United Kingdom). Even though no bleeding complications occurred, different platelet behavior was observed in the Perceval S valve group. Specifically, postoperative platelets declined in both the groups after aortic valve replacement; however, patients with the Perceval S valve showed a significant lower platelet count than did those with the Intuity valve on the third and fifth postoperative days as well as at discharge. In addition, mean platelet volume and platelet distribution width were statistically higher in the Perceval S valve group on the third and fifth postoperative days, indicating that the Perceval S valve may induce platelet activation.

The Perceval S valve is a new generation bovine pericardium sutureless bioprosthesis and represents the evolution of the Freedom SOLO (LivaNova), a stentless valve that has been sometimes associated with postoperative thrombocytopenia.^{2,4} This phenomenon, however, was never associated with any adverse clinical event. Many articles have described excellent clinical outcomes with sutureless valves, but few of them have reported thrombocytopenia as a potential complication.^{6,7} In this setting, Jiritano and colleagues⁵ are the first to focus mainly on the platelet behavior with 2 different sutureless valves, and in a multivariable analysis the Perceval S valve was found to be associated with an increased risk of platelet count reduction. This study is limited, however, by the small sample size; in addition, no odds ratios are reported, so that we are not able to understand the real “weight” of this variable in predicting thrombocytopenia. Interestingly, at 1-year follow up, platelet counts were similar between the groups, highlighting the concept that the platelet dysfunction and thrombocytopenia are transient. Finally, no information has been reported on preoperative drug medications, renal function and heparin-induced thrombocytopenia. All these factors may affect the platelet function and count.¹

The cause of thrombocytopenia is unknown and under investigation in some centers.² Several hypotheses have been raised to explain this phenomenon. According to Jiritano and colleagues⁵ and others, the storage solution, the microhemodynamic effect of the prosthesis or the naked alloy stent of the Perceval S valve might induce platelet activation and thrombocytopenia. The Perceval S valve does not require rinsing before implantation because it is detoxified with homocysteic acid and stored in aldehyde-free solution. Homocysteic acid could activate several molecular mechanisms, resulting in platelet activation and thrombocytopenia⁸; however, this solution is also used for other LivaNova valves, suggesting a different mechanism than toxicity. In addition, it is important to underline that homocysteic acid is present in healthy human beings as a product of the spontaneous

oxidation of homocysteine and that the residual amount of homocysteic acid that could be transferred to the patient is negligible.⁹

A mechanical stress of the prosthesis on the platelet could be another cause of thrombocytopenia; however, the Perceval S valve has always shown excellent hemodynamic performances, and this hypothesis is therefore improbable. Finally, a consideration on the type of the stent valve is necessary. Differently from the Intuity valve, in which the sealing cloth covers the stainless steel frame, the alloy stent of the Perceval S valve is naked, and that could induce thrombocytopenia. Major thrombocytopenia has been also observed in patients undergoing transcatheter aortic valve implantation. Jilaihawi and coworkers¹⁰ have found that thrombocytopenia is a common phenomenon after implantation of the Edwards-Sapien valve (Edwards Lifesciences). This complication has not been observed in patients receiving CoreValve (Medtronic, Minneapolis, Minn); however, where its nitinol frame is completely naked.

In conclusion, thrombocytopenia is a common and complex phenomenon observed after aortic valve replacement. Plenty of risk factors may affect the platelet function inducing thrombocytopenia, but none of these were investigated in the study of Jiritano and colleagues.⁵ I suggest that they design a better study evaluating all molecular aspects of thrombocytopenia induced by the sutureless valves. As described for the SOLO valves, the Perceval S valve might induce thrombocytopenia in absence of clinical complications; however, a clear explanation has not still been given. The mystery goes on.

References

1. Weerasinghe A, Taylor KM. The platelet in cardiopulmonary bypass. *Ann Thorac Surg*. 1998;66:2145-52.
2. Miceli A, Gilmanov D, Murzi M, Parri MS, Cerillo AG, Bevilacqua S, et al. Evaluation of platelet count after isolated biological aortic valve replacement with Freedom Solo bioprosthesis. *Eur J Cardiothorac Surg*. 2012; 41:69-73.
3. van Straten AH, Hamad MA, Berreklouw E, ter Woort JF, Martens EJ, Tan ME. Thrombocytopenia after aortic valve replacement: comparison between mechanical and biological valves. *J Heart Valve Dis*. 2010;19:394-9.
4. Piccardo A, Rusinaru D, Petitprez B, Marticho P, Vaida I, Tribouilloy C, Caus T. Thrombocytopenia after aortic valve replacement with Freedom Solo bioprosthesis: a propensity study. *Ann Thorac Surg*. 2010;89:1425-30.
5. Jiritano F, Cristodoro L, Malta E, Mastroroberto P. Thrombocytopenia after sutureless aortic valve implantation: comparison between Intuity and Perceval bioprostheses. *J Thorac Cardiovasc Surg*. 2016;152:1631-3.
6. Flameng W, Herregods MC, Hermans H, Van der Mieren G, Vercauteren M, Poortmans G, et al. Effect of sutureless implantation of the Perceval S aortic valve bioprosthesis on intraoperative and early postoperative outcomes. *J Thorac Cardiovasc Surg*. 2011;142:1453-7.
7. Albacter TB. Thrombocytopenia associated with Perceval sutureless aortic valve replacement in elderly patients: a word of caution. *Heart Surg Forum*. 2015;18: E093-7.
8. Albacter TB. Invited commentary. *Ann Thorac Surg*. 2010;89:1430-1.
9. Boldyrev AA. Molecular mechanisms of homocysteine toxicity. *Biochemistry*. 2009;74:589-98.
10. Jilaihawi H, Doctor N, Chakravarty T, Kashif M, Mirocha J, Cheng W, et al. Major thrombocytopenia after balloon-expandable transcatheter aortic valve replacement: prognostic implication and comparison to surgical aortic valve replacement. *Catheter Cardiovasc Interv*. 2015;85:130-7.