Anadolu Kardiyol Derg
2008; 8: 81-88

Prevention of calcification with TPEN in pericardial bio-prosthetic heart valve material

Biyoprostetik kalp kapağı materyalinde kalsifikasyonun TPEN ile önlenmesi

On December 2007 issue of the Anatolian Journal of cardiology, an article entitled "Prevention of calcification with TPEN in pericardial bioprosthetic heart valve material" was published (1). As bio-prosthetic heart valves are more frequently being used in valve replacement procedures today, the authors' findings are of paramount importance. Calcification of bio-prosthetic heart valves, a tissue degeneration process of unpredictable onset and amount, is a major factor limiting their long-term function (2). Since this process alters the structure and function of the valve and consequently shortens its lifespan and also as it is the major pathologic process necessitating bio-prosthetic valve re-operations, efforts to prevent formation of mineral deposits are active and many approaches, such as anti-mineralization treatment have been tried (3, 4).

Döndaş et al. (1) in their attempt to avoid the destructive process of bio-prosthetic heart-valve calcification, tried to prevent calcification of pericardial bio-prosthetic heart valve materials using TPEN. This is a novel and informative work, but unfortunately with limited clinical impact, finally. The authors reported that using TPEN, fibroblasts were structurally well preserved, while in the control group, there were fibroblasts displaying irregular cell contours and subsequently extensive cell degeneration was observed. These findings are encouraging, but it should be kept in mind that biomechanical impacts of these cellular changes are more important when the valve works in physiologic situations. Although using TPEN, calcium content of the valves was significantly lower than in the control group, as time passed, no significant differences in maximum stress, maximum strain and toughness were observed between the groups. In fact, investigators failed to improve the properties of the valves in the biomechanical tests. Hence, this seems that the application of this substance adds no clinical or functional advantage in improving function and durability of the bio-prosthetic valves in vivo and there is no strong evidence or promotion to examine TPEN in human.

Another point of weakness about this paper was that, for histological analysis of the specimens, it seems that the study was not single-blinded. In fact, when the researchers know which group the subjects are in, it can be a major concern about the reliability of the reported results, particularly if they are not quantitative and graded. As it is obvious, researchers' knowledge of receiving TPEN or placebo is likely to affect the interpretation of histological features of two groups.

In our opinion, regarding beneficial effects of the TPEN on bio-prosthetic halve valves as determined by Döndaş et al. (1), the study should be repeated in situations more resembling human physiologic conditions. In addition, the study findings promote investigators to seek more effective substances or tools to improve the durability and in vivo function of the valves.

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Author Reply

Dear Editor,

In response to the "Letter to editor" criticizing our article entitled "Prevention of Calcification with TPEN in Pericardial Bioprosthetic Heart Valve Material" we would like to clarify the subject.

In this study, we aimed to reduce and/or to remove calcific degeneration, which is effective in the durability and the function of the valve by using chelating agent TPEN. As a difference from our previous studies (1-3), lipid soluble form of TPEN give us an expectation for having better results. Calcification was reduced significantly in the study group as indicated in the article, but this reduction did not reach desired level and it is observed that calcification increased gradually with the time. Concordant histopathologic results were obtained. Single-blinded approach was used in our study. On the other hand, discordant biomechanical results might be related with other structural elements in pericardium rather than collagen. As we emphasized in the discussion section satisfactory results could not be taken from the TPEN and we also clearly explained that TPEN could only be used as an adjuvant agent.

Studies of the bioprosthetic heart valve materials are being achieved with the subdermal implantation to the rat or direct cardiac implantation to the sheep or cow. Surgical difficulties and expensiveness of the big animals directed the researchers to use small animals in their studies. It is pointed out that results obtained from subdermal models were found to be similar and concordant with the results obtained from direct implantation (4). So, I believe that subdermal models will be sufficient for the initial studies regarding pericardial calcific degeneration.

With my best regards,

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