

COMMENT AND OPINION

Connective tissue overgrowth on a titanium plug inserted to facilitate left ventricular assist device explantation

AQ: 1

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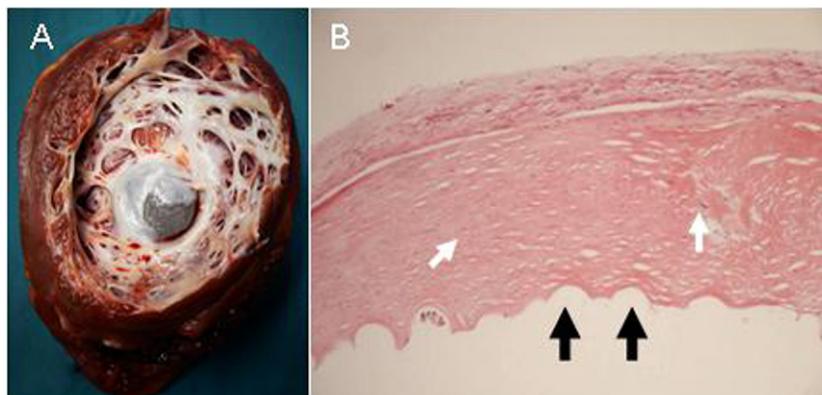
We recently reported facilitated explantation of a HeartMate II (Thoratec, Pleasanton, CA) left ventricular assist device (LVAD) in 4 patients by using an individually designed and manufactured titanium plug that avoided any manipulation of the left ventricular apex.¹ The main question unexplored was the nature of the interaction between the surface, which is sintered with titanium microspheres, and the heart and blood.

In 1 patient, heart failure unfortunately became evident again 4 months after removal of the LVAD and plug insertion. The patient had received 3 months of vitamin K antagonist treatment, followed by 100 mg aspirin daily, after device explantation. After 1 month (5 months after surgery) on the waiting list, he received heart transplantation. No infection, effusion, or false aneurysm was noted in the pericardium around the plug. Examination of the explanted heart showed that the plug was protruding into the cavity of the left ventricle by 1 to 2 mm and that two thirds of its luminal surface was covered by strongly

adherent tissue that had originated from the adjacent endocardium (Figure 1A). The other third of the plug surface protruding into the chamber of the left ventricle was covered by a thin proteinaceous layer. No adherent thrombus was seen.

Histopathologic examination (hematoxylin and eosin staining) showed a membrane of 1 mm thickness, consisting of a collagenous matrix and a low to moderate number of fibroblasts (Figure 1B). No other cell forms were found in the membrane, in particular, no inflammatory cells such as lymphocytes or macrophages. No smooth muscle cells and no neovascularization of the membrane were observed. The latter was confirmed by CD31 immunohistochemistry, which showed no positive cells. Therefore, we can exclude that the ventricular surface of the membrane was endothelialized. The fibrotic tissue was strongly adherent to the artificial surface, filling all gaps between the microspheres, as could be seen at the site in contact with the plug, which mirrors the structure of the sintered plug surface (semicircular “saw-blade-like” structures).

This case shows that the individually designed and manufactured titanium plug for the explantation of LVADs may become completely covered by connective tissue. In our opinion, treatment with anticoagulants in patients with an implanted plug should be continued for at least 6 months until complete formation of a fibrotic layer over the artificial



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AQ: 3

Figure 1 (A) This view of the plug in situ from inside the left ventricle immediately after explantation of the heart shows that connective tissue covers the sides and approximately two thirds of the surface protruding into the left ventricle. (B) The newly formed membrane consists of collagenous connective tissue, which is rich in eosinophilic fibers and bears a low to moderate number of cells with small, spindle shaped, uniform nuclei (white arrows). No inflammatory infiltrate is visible. The side facing the plug clearly shows imprints of the spheres that cover the plug (black arrows). The opposite side, facing the ventricular lumen, is smooth (hematoxylin and eosin staining, original magnification $\times 100$).

surface takes place, followed by treatment with 100 mg aspirin daily. These recommendations require further confirmation.

Disclosure statement

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AQ: 2

Reference

1. Potapov EV, Stepanenko A, Hennig E, Hetzer R, Krabatsch T. A titanium plug simplifies left ventricular assist device removal after myocardial recovery. *J Heart Lung Transplant* 2010 [E-pub ahead of print: doi:10.1016/j.healun.2010.06.008].