February 13, 2020

LeMaitre Vascular
John Bradsher
Senior Regulatory Affairs Specialist
63 Second Avenue
Burlington, Massachusetts 01803

Re: K190882
Trade/Device Name: XenoSure Biologic Patch
Regulation Number: 21 CFR 870.3470
Regulation Name: Intracardiac Patch Or Pledget Made Of Polypropylene, Polyethylene Terephthalate, Or Polytetrafluoroethylene
Regulatory Class: Class II
Product Code: PSQ
Dated: April 2, 2019
Received: April 4, 2019

Dear John Bradsher:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database located at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803) for devices or postmarketing safety reporting (21 CFR 4, Subpart B) for combination products (see https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance) and CDRH Learn (https://www.fda.gov/training-and-continuing-education/cdrh-learn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Rachel Neubrander, Ph.D.
Assistant Director
DHT2B: Division of Circulatory Support,
Structural and Vascular Devices
OHT2: Office of Cardiovascular Devices
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K190882

Device Name
XenoSure Biologic Patch

Indications for Use *(Describe)*
The XenoSure Biologic Patch is intended for use as a surgical patch material for cardiac and vascular reconstruction and repair, soft tissue deficiency repair and reinforcing the suture line during general surgical procedures.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

This section applies only to requirements of the Paperwork Reduction Act of 1995.

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K190882 510k Summary

Submitter's Information **Name:** **Address:** **Phone:** **Fax:**	 LeMaitre Vascular, Inc. 63 Second Avenue, Burlington, MA 01803 781-425-1706 781-425-5049
Contact Person:	Xiang (Vic) Zhang VP of Regulatory Affairs LeMaitre Vascular, Inc. Email: xzhang@lemaitre.com
Date Prepared: **Device Name:**	February 13, 2020 XenoSure Biologic Patch
Trade Name:	XenoSure Biologic Patch
Common Name:	Intracardiac patch or pledget
Regulation Number: **Classification Panel:** **Class:** **Product Code:** **Establishment Registration**: **Establishment:**	21 CFR 870.3470 Cardiovascular II (2) PSQ 1220948 63 Second Avenue Burlington, MA 01803
Predicate Device:	XenoSure Biologic Patch (K040835)
Reference Device:	None
Device Description:	The XenoSure consists of one piece of bovine pericardial tissue that has been selected for minimal tissue blemishes. The tissue is treated with a glutaraldehyde process which crosslinks the collagen fibers and minimizes antigenicity. XenoSure patch is liquid chemical sterilized and packaged in a plastic jar containing sterile glutaraldehyde storage solution.

Indication for Use:	The XenoSure Biologic Patch is intended for use as a surgical patch material for cardiac and vascular reconstruction and repair, soft tissue deficiency repair and reinforcing the suture line during general surgical procedures.
Summary of Technological Characteristics:	The purpose of this submission is to support the labeling change of removing the warning that XenoSure cannot be frozen. No change to the device design, materials, packaging materials, or manufacturing processes. The only change is to underfill the final package to tolerate the expected expansion if the storage solution is frozen. Comparisons of the XenoSure Biologic Patch (frozen) with the predicate XenoSure Biologic Patch (unfrozen) show that technological characteristics such as materials, biocompatibility, performance, and sterilization of the proposed device are substantially equivalent to the predicate device. The difference between the proposed device and the predicate device is the proposed device labeling will allow the device to be exposed to temperature below 0°C while the predicate device labeling warns against that. For the subject device, the storage solution is under-filled to accommodate potential frozen expansion. This difference was evaluated to demonstrate substantial equivalence via performance testing and an in-vivo animal study.

	Proposed Device Product Name: **XenoSure Biologic Patch**	**Predicate Device** Product Name: **XenoSure Biologic Patch**	**Comparison**
Manufacturer	LeMaitre Vascular Inc.	LeMaitre Vascular Inc.	Same
Clearance	This submission	K040835	
Indications for Use	The XenoSure® Biologic Patch is intended for use as a surgical patch material for cardiac and vascular reconstruction and repair, soft tissue deficiency repair and reinforcing the suture line during general surgical procedures.	The XenoSure® Biologic Patch is intended for use as a surgical patch material for cardiac and vascular reconstruction and repair, soft tissue deficiency repair and reinforcing the suture line during general surgical procedures.	Same
Materials	Bovine pericardium	Bovine pericardium	Same
Design	Various size patches	Various size patches	Same
Sterility	Chemical sterilization with 10^{-6} SAL	Chemical sterilization with 10^{-6} SAL	Same
Single Use	Yes	Yes	Same
Medical Specialists	Cardiovascular	Cardiovascular	Same
Packaging	Jar/Lid, carton	Jar/Lid, carton	Same
Storage solution	0.2% glutaraldehyde	0.2% glutaraldehyde	Same

Shelf Life	6 years	6 years	Same

Functional/Safety Testing:	The verification activities conducted indicate that XenoSure biologic patch (frozen) meets the product performance requirements of the device specifications and does not raise any additional safety issues.
Sterilization:	XenoSure biologic patch is chemically sterilized according to ISO14160: 2011, "Sterilization of health care products -- Liquid chemical sterilizing agents for single-use medical devices utilizing animal tissues and their derivatives -- Requirements for characterization, development, validation and routine control of a sterilization process for medical devices".
Biocompatibility:	The material for XenoSure Biologic Patch is bovine pericardium. It is identical to that in the predicate device which has established biocompatibility. There is no change to the materials, manufacturing process, or packaging for this submission and the biocompatibility is not affected.
Summary of Product Testing:	The following tests have been completed on baseline and aged product to evaluate the XenoSure Biologic Patch (frozen) in comparison to the predicate device (unfrozen patch): • Longitudinal Tensile test • Burst strength test • Suture retention test • Water Permeability • Elongation • Cross Linking test • Collagenase digestion • Delamination

Test	**Test method summary**	**Results**
Longitudinal Tensile	Use Instron pull the sample until it fails. Record the ultimate tensile strength in MPa.	All XenoSure patches passed the acceptance criteria of ≥ 2 MPa. The mean of tensile strength of the predicate device (unfrozen) was measured as 12.9 MPa. The mean of tensile strength of XenoSure patch (frozen) was measured as 12.1 MPa. There is no statistical difference.
Elongation	Use Instron pull the sample until it fails. Record the elongation at the failure as percent of the original sample length.	All XenoSure patches passed the acceptance criteria of 5~50% elongation. The mean of elongation of the predicate device was measured as 21.8%. The mean of elongation of XenoSure patch (frozen) was measured as 22.3%. There is no statistical difference.

Burst strength	Sample is secured in the testing fixture as a membrane between two chambers. One side of the sample is slowly pressurized using water. Record the pressure at the time of burst or leak.	All XenoSure patches passed the acceptance criteria of ≥ 12 PSI. The mean of burst strength of the predicate device (unfrozen patch) was measured as 134 PSI. The mean of burst strength of XenoSure patch (frozen) was measured as 113 PSI. They are statistically different. However, since both results are much higher than the clinical specification of 12PSI, the difference does not have any clinical significance.
Suture retention	Make sutures on the edge of the patch. Pull the suture using Instron until either patch or suture fail. Record the force at the failure.	All XenoSure patches passed the acceptance criteria of ≥ 300 gf. The mean of suture retention of the predicate device was measured as 1233 gf. The mean of suture retention of XenoSure patch (frozen) was measured as 1235 gf. There is no statistical difference.
Cross Linking	This test is to determine the degree of cross-linking of collagen based materials by measuring the amounts of unreacted amino groups. Free amino groups will bind to 2,4,6-trinitrobenzenesulfonic acid (TNBS) and the remaining TNBS is reacted with glycine to produce a complex that absorbs strongly at 340 nm and can be quantitatively measured by UV-Vis Spectrophotometry. The number of free amine sites is calculated using a pre- and post-test calibration curve and the absorbance of the test sample.	There is no acceptance criteria for this test. The cross linking of the predicate (unfrozen patch) is 29 ppm free amine site per gram. The cross linking of the proposed (frozen) patch is 28 ppm free amine site per gram. The test results show there is no statistical difference between the proposed and predicate devices.
Collagenase Digestion	This test is to determine the digestion rates of biological tissue by collagenase digestion. Collagenase will cleave glycine bonds in collagen, breaking tissue down into peptides. Depending on the type of tissue and crosslinking used, the biologic tissues can exhibit different digestion rates.	There is no acceptance criteria for this test. The digestion of the predicate (unfrozen patch) is 0.16%. The digestion of the proposed (frozen patch) is 0.18%. The test results show there is no statistical difference between the proposed and predicate devices.
Water Permeability	This test is to measure the water permeability of the tissue under 120 mmHg pressure.	The acceptance criteria is < 0.1 ml/cm^2·min All samples for both predicate and proposed devices recorded zero water permeability and therefore are not statistically different.
Delamination	This is a visual inspection. The operator inspects the patch for delamination.	No delamination was identified for both the predicate and proposed devices.

Summary of Pre-clinical Study:	The objective of this study was to evaluate the safety of a previously frozen XenoSure Biologic Vascular Patch (test patch) in comparison to a non-frozen XenoSure Biologic Vascular Patch (control/predicate patch). Seven Polypay sheep underwent a single surgical procedure on Day 0, in which bilateral vascular patches were implanted following an arteriotomy and animals were recovered for 90 days. The previously frozen XenoSure Biologic Vascular Patch (test) was implanted in one carotid artery and the non-frozen XenoSure Biologic Vascular Patch (control) was implanted in the opposite carotid artery, for each animal. Activated clotting times were monitored during the surgical procedure. Aspirin was administered for antiplatelet therapy at least once every 5 days until euthanasia. Angiographic assessments were performed on Day 0 (before and after patch implant completion) and before necropsy. Ultrasound was also performed on Day 0 after carotid artery skin incision closure, at interim time points, and prior to necropsy. Animal health was monitored via incision site and clinical observations, body weights/condition and clinical pathology, at pre-determined, regular intervals. On Days 89-90 the animals were euthanized and comprehensive necropsies were performed. The patch-implanted carotid arteries were collected and processed for histopathologic evaluation. Additionally, representative tissues/organs were collected and will be archived with the study materials. Six of seven animals survived to the scheduled time point. Following implantation, all carotid patches were noted to achieve appropriate sealing (i.e., there were no leaks) prior to closure. One animal was euthanized on Day 21 due to poor prognosis after chronic inappetance and observation of pale conjunctiva and mucous membranes. Early euthanasia of the animal was interpreted to be unrelated to the carotid patches themselves. Both test and control carotid patches did not affect vessel patency based on angiography and ultrasound analysis. Histologically, implantation of the previously frozen XenoSure Biologic Vascular Patch was associated with favorable local tissue responses (such as endothelialization, tissue integration and absence of adverse effects) that were comparable to those seen with the control device, nonfrozen XenoSure Biologic Vascular Patch. Statistical comparison between treatment groups showed no significant differences between any of the compared histologic parameters associated with the bovine pericardium patches. Overall, the previously frozen XenoSure Biologic Vascular Patch (test patch) displayed bioequivalence and comparable characteristics in vascular safety, local tissue response, endothelialization, and tissue integration to the non-frozen XenoSure Biologic Vascular Patch (control/predicate patch).

Conclusion:	LeMaitre Vascular has demonstrated that XenoSure Biologic Patch (frozen) is substantially equivalent to the predicate device (unfrozen patch) based on its intended use and fundamental scientific technology.