华东师范大学学报(自然科学版)
JOURNAL OF EAST CHINA NORMAL UNIVERSITY NATURAL SCIENCES

华东师范大学学报(自然科学版) » 2012, Vol. 2012 » Issue (4): 50-60 DOI:

适用于不同尺寸血管的脱细胞方法研究

张红霞[1]， 翟万银[2]， 张红锋[1]

1.华东师范大学 生命科学学院， 上海 200062； 2.中国科学院 上海硅酸盐研究所 高性能陶瓷与超微结构国家重点实验室， 上海 200050

A general decellularization method for preparing vascular scaffolds from blood vessels of different types, diameters and wall-thicknesses

ZHANG Hong-xia[1], ZHAI Wan-yin[2], ZHANG Hong-feng[1]

1.School of Life Science, East China Normal University, Shanghai 200062, China; 2.State Key Laboratory of High Performance Ceramics and Superfine Microstructure, Shanghai Institute of Ceramics, Chinese Academy of Sciences, Shanghai 200050, China

- 摘要
- 参考文献
- 相关文章

全文: PDF (5808 KB) HTML (1 KB) 输出: BibTeX | EndNote (RIS) 背景资料

摘要 将胰酶消化与反复冻融相结合，旨在建立一种适用于各种类型血管的通用脱细胞方法，如隐静脉、颈动脉和主动脉。隐静脉、颈动脉和主动脉经胰酶消化和反复冻融脱细胞处理后，采用苏木精—伊红染色、Masson三色染色及弹性纤维染色来定性评价脱细胞效果和细胞外基质的保存效果，采用Image-Pro-Plus 5.1图像处理软件作进一步定量评价；扫描电子显微镜观察胞外基质的完整性。结果显示，组织染色及定量分析表明此胰酶消化与反复冻融相结合的方法完全脱除了隐静脉、颈动脉和主动脉得细胞，细胞外介质结构保存良好且完整。扫描电子显微镜观察亦表明细胞外基质保存良好，且基质纤维致密规整。表明胰酶消化与反复冻融相结合的脱细胞方法是一种很有前景的制备各种不同类型血管支架的方法。

关键词： 脱细胞 细胞外基质 隐静脉 颈动脉 主动脉

Abstract： This study was to build a general decellularization method by combining trypsinization with repeated frozen/thawing treatment for different types of vessels including saphenous vein, carotid artery and aorta. Saphenous vein, carotid artery and aorta were decellularized by trypsinization and repeated frozen/thawing treatment. The efficiencies of cell removal and extracellular matrix (ECM) integrity were examined by Hematoxylin and eosin staining, Masson Trichrome staining and Weigert’ s staining. A quantitative means based on image analysis software was used to quantify the ECM preservation. Scanning electron microscopy was used to show the extracellular matrix integrity. Histology staining and quantitative analysis demonstrated trypsinization with repeated frozen/thawing treatment decellularized the saphenous vein, carotid artery and aorta completely. The ECM structure was optimally preserved and integrity. Scanning electron microscopy examination also showed the ECM was well-preserved and the fibers were dense and orderly. The present results revealed that the trypsinization with repeated frozen/thawing method is a promising one for preparing decellularized vascular scaffolds of different types, sizes and wall-thicknesses of blood vessels.

Key words： decellularization extracellular matrix saphenous vein carotid artery aorta

收稿日期: 2011-04-01; 出版日期: 2012-07-25

引用本文:

. 适用于不同尺寸血管的脱细胞方法研究[J]. 华东师范大学学报(自然科学版), 2012, 2012(4): 50-60.

. A general decellularization method for preparing vascular scaffolds from blood vessels of different types, diameters and wall-thicknesses[J]. Journal East China Normal University(Natural Sc, 2012, 2012(4): 50-60.

服务
把本文推荐给朋友
加入我的书架
加入引用管理器
E-mail Alert
RSS
作者相关文章

[1] CHO S W, LIM S H, KIM I K, et al. Small-diameter blood vessels engineered with bone marrow-derived cells[J]. Ann Surg, 2005, 241: 50 515.

[2] ISENBERG B C, WILLIAMS C, TRANQUILLO R T. Small-diameter artificial arteries engineered in vitro[J]. Circ Res, 2006, 98: 25-35.

[3] GUSIC R J, PETKO M, MYUNG R, et al. Mechanical properties of native and ex vivo remodeled porcine saphenous veins[J]. J Biomech, 20
38: 1770-1779.

[4] SCHANER P K, MARTIN N D, TULENKO T N, et al. Decellularized veins as a potential scaffold for vascular tissue engineering[J]. J Vasc S
2004, 40: 146-152.

[5] CONKLIN B S, RICHTER E R, KREUTZIGER K L, et al. Development and evaluation of a novel decellularized vascular xenograft[J]. Med En
Phys, 2002, 24: 173-183.

[6] WILLIAMS C, LIAO J, JOYCE E M, et al. Altered structural and mechanical properties in decellularized rabbit carotid arteries[J]. Acta
Biomaterialia, 2009(5): 993-1005.

[7] SHUM-TIM D, STOCK U, HRKACH J, et al. Tissue engineering of autologous aorta using a new biodegradable polymer[J]. Ann Thorac Su
1999, 68: 2298-2304.

[8] LIU G F, HE Z J, YANG D P, et al. Decellularized aorta of fetal pigs as a potential scaffold for small diameter tissue engineered vascular
[J]. Chin Med J, 2008, 121: 1398-1406.

[9] ZENG W, YUAN W, LI L, et al. The promotion of endothelial progenitor cells recruitment by nerve growth factors in tissue-engineered bl
vessels[J]. Biomaterials, 2010, 31: 1636-1645.

[10] ZHAO Y, ZHANG S, ZHOU J, et al. The development of a tissue-engineered artery using decellularized scaffold and autologous ovine
mesenchymal stem cells[J]. Biomaterials, 2010, 31: 296-307.

[11] LEVY R J, SCHOEN F J, ANDERSON H C, et al. Cardiovascular implant calcification: A survey and update[J]. Biomaterials, 1991(12): 707
714.

[12] GIBERT T W, SELLARO T L, BADYLAK S F. Decellularization of tissues and organs[J]. Biomaterials, 2006, 27: 3675-3683.

[13] ALLAIRE E, GUETTIER C, BRUNEVAL P, et al. Cell-free arterial grafts: Morphologic characteristics of aortic isografts, allografts and
xenografts in rats[J]. J Vasc Surg, 1994, 19: 446-456.

[14] VOET D, VOET J G, PRATT C W. Fundamentals of Biochemistry[M]. New York: Wiley, 2002.

[15] LU X, ZHAI W, ZHOU Y, et al. Crosslinking effect of nordihydroguaiaretic acid (NDGA) on decellularized heart valve scaffold for tissue
engineering[J]. J Mater Sci Mater Med, 2010, 21: 473-480.

[16] SEDDON A M, CUMOW P, BOOTH P J. Membrane Proteins, Lipids and detergents: Not just a soap opera[J]. Biochim Biophys Acta, 2004,
1666: 105-117.

[17] DAHL S L, KOH J, PRABHAKAR V, et al. Decellularized native and engineered arterial scaffolds for trans-plantation[J]. Cell Transplant, 20
(12): 659-666.

[18] RIEDER E, KASIMIR M T, SILBERHUMER G, et al. Decellularization protocols of porcine heart valves differ importantly in efficiency of cell
removal and susceptibility of the matrix to recellularization with human vascular cell[J]. J Thorac Cardiovasc Surg, 2004, 127: 399-405.

[19] BADER A, STEINHOFF G, STROBL K, et al. Engineering of human vascular aortic tissue based on a xenogeneic starter matrix[J].
Transplantation, 2000, 70: 7-14.

[20] CRAPO P M, GILBERT T W, BADYLAK S F. An overview of tissue and whole organ decellularization processes[J]. Biomaterials, 2011, 32:
3233-3243.

[21] JACKSON DW, GROOD E S, AMOCZKY S P, et al. Cruciate reconstruction using freeze dried anterior cruciate ligament allograft and a
ligament augmentation device (LAD). An experimental study in a goat model[J]. Am J Sports Med, 1987, 15: 528-538.

[22] JACKSON D W, GROOD E S, AMOCZKY S P, et al. Freeze dried anterior cruciate ligament allografts. preliminary studies in a goat model[,
Am J Sports Med, 1987, 15: 295-303.

[23] JACKSON D W, GROOD E S, COHN B T, et al. The effects of in situ freezing on the anterior cruciate ligament. an experimental study in
goats[J]. J Bone Joint Surg Am, 1991, 73: 201-213.

[24] JACKSON D W, GROOD E S, WILCOX P, et al. The effects of processing techniques on the mechanical properties of bone-anterior cruci
ligament-bone allografts. An experimental study in goats[J]. Am J Sports Med, 1988, 16: 101-105.

[25] JACKSON D W, WINDLER G E, SIMON T M. Intraarticular reaction associated with the use of freeze-dried, ethylene oxide-sterilized bone
patella tendon-bone allografts in the reconstruction of the anterior cruciate ligament[J]. Am J Sports Med, 1990, 18: 1-10.

[26] ROBERTS T S, DREZ D, MCARTHY W, et al. Anterior cruciate ligament reconstruction using freeze-dried, ethylene oxide-sterilized, bone
patellar tendon-bone allografts. Two year results In thirty-six patients[J]. Am J Sports Med, 1991, 19: 35-41.

[27] GULATI A K. Evaluation of acellular and cellular nerve grafts in repair of rat peripheral nerve[J]. J Neurosurg, 1988, 68: 117-123.

[28] ZHOU J, FRITZE O, SCHLEICHER M, et al. Impact of heart valve decellularization on 3-D ultrastructure, immunogenicity and thromboger
[J]. Biomaterials, 2010, 31: 2549-2554.

[29] FUNAMOTO S, NAM K, KIMURA T, et al. The use of high-hydrostatic pressure treatment to decellularize blood vessels[J]. Biomaterials,
2010, 31: 3590-3595.

[30] BADER A, SCHILLING T, TEEBKEN O E, et al. Tissue engineering of heart valves human endothelial cell seeding of detergent acellularized
porcine valves[J]. Eur J Cardiothoracic Surg, 1998, 14: 279-284.

[31] HU G, XING B, OU L, et al. Decellularization of arteries and evaluation of extracellular matrix as scaffolds [J]. Chin J Biomed Eng, 2008, 2

912-921.

[32] SHAO J, WU L, WU J, et al. Integrated microfluidic chip for endothelial cells culture and analysis exposed to a pulsatile and oscillatory s stress [J]. Lab Chip, 2009, 9(21): 3118-3125.

[33] SHAO J, WU L, WU J, et al. A microfluidic chip for permeability assays of endothelial monolayer [J]. Biomed Microdevices, 2010, 12(1): 8 88.

[34] ROBERT L, HORNEBECK W. Elastin and Elastases[M]. Florida: CRC Press, Inc., 1989: 11-18. [35] JOSSET Y, NASRALLAH F, JALLOT E, et Influence of physicochemical reactions of bioactive glass on the behavior and activity of human osteoblasts in vitro[J]. J Biomed Mater 2003, 67: 1205-1218.

[35] ZHAO L, CHANG J, ZHAI W. Effect of crystallographic phases of TiO2 on hepatocyte attachment, proliferation and morphology[J]. J Biomater Appl, 2005, 19: 237-252.

[36] DAHL S L, KOH J, PRABHAKAR V, et al. Decellularized native and engineered arterial scaffolds for trans-plantation[J]. Cell Transplant, 20 (12): 659-666.

[37] SCHMIDT C E, BAIER J M. Acellular vascular tissues: Natural biomaterials for tissue repair and tissue engineering[J]. Biomaterials, 2000, 2215-2231.

[38] OTT H C, MATTHIESEN T S, GOH S K, et al. Perfusion-decellularized matrix: Using nature’s platform to engineer a bioartificial heart[J] Med, 2008, 14: 213-221.

[39] PENTERSEN T H, CALLE E A, ZHAO L, et al. Tissue-engineered lungs for in vivo implantation[J]. Science, 2010, 329: 538-541.

[1] 张红霞, 翟万银, 张红锋. 适用于不同尺寸血管的脱细胞方法研究[J]. 华东师范大学学报(自然科学版), 0, (): 1-11.