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Application of artificial oxygen-carrying hemoglobin vesicles for marginal liver grafts in machine perfusion preservation

Research Project

Project/Area Number	17K10503
Research Category	Grant-in-Aid for Scientific Research (C)
Allocation Type	Multi-year Fund
Section	一般
Research Field	General surgery
Research Institution	Asahikawa Medical College
Principal Investigator	Matsuno Naoto 旭川医科大学, 医学部, 特任教授 (00231598)
Co-Investigator(Kenkyū-buntansha)	酒井 宏水 奈良県立医科大学, 医学部, 教授 (70318830) 小原 弘道 首都大学東京, システムデザイン研究科, 准教授 (80305424)
Project Period (FY)	2017-04-01 – 2020-03-31
Project Status	Completed (Fiscal Year 2019)
Budget Amount *help	¥4,550,000 (Direct Cost: ¥3,500,000、Indirect Cost: ¥1,050,000) Fiscal Year 2019: ¥1,430,000 (Direct Cost: ¥1,100,000、Indirect Cost: ¥330,000) Fiscal Year 2018: ¥1,560,000 (Direct Cost: ¥1,200,000、Indirect Cost: ¥360,000) Fiscal Year 2017: ¥1,560,000 (Direct Cost: ¥1,200,000、Indirect Cost: ¥360,000)
Keywords	肝臓保存 / 機械灌流保存 / 人工赤血球 / 移植臓器保存液 / 心停止ドナー肝 / 臓器灌流保存 / 心肺停止ドナー / 虚血再灌流障害 / 1 肝臓灌流保存 / 2 心停止ドナー / 3 人工赤血球含有灌流液 / 4 虚血再灌流障害 / 移植・再生医療
Outline of Final Research Achievements	Pig livers were excised after 60 minutes of warm ischemic time and were preserved under one of three preservation conditions for 4 hours. The preservation conditions were as follows: cold storage (CS group; N = 5), Hypothermic machine preservation (HMP) (HMP group; N = 5), subnormothermic MP (21° C) ; N = 5) SNMP with HbVs (SNMP+HbV group; N = 5). Autologous blood perfusion was performed for 2 hours in an isolated liver reperfusion model). The oxygen consumption of the SNMP and SNMP +HbV group was higher than the HMP groups (p < 0.05). During the reperfusion, AST level in the SNMP+HbV group was lower than that in the CS, HMP and SNMP groups. The changes in pH was significantly lower in SNMP+HbV group. The ultrastructural findings indicated that the mitochondria of the SNMP+HbV group was well maintained. The SNMP +HbVs preservation solution protected against metabolic acidosis and preserved the liver function after reperfusion injury in the DCD liver.
Academic Significance and Societal Importance of the Research Achievements	研究成果は、ブタを用いた前臨床的研究であること、灌流保存技液による臓器機能回復をめざした点で我が国初の画期的研究成果だと考えている。臓器移植手術では、移植直前に臓器内血球成分を洗い流すため、人工赤血球が体内に入ることではなく、臨床応用のハードルは高くないと考えている。今回、虚血再灌流障害を抑制することに成功した。心停止肝臓のみならず、小児医療などで期待の高い分割肝あるいは脂肪肝など適用に課題のある臓器移植を可能とする可能性がある。赤血球循環技術はdrug delivery systemや臓器培養、再生医療との共創により次世代型治療との複合による新しい時代の研究を切り開くプラットフォームになる

Report (4 results)

- 2019 Annual Research Report Final Research Report ( PDF)
- 2018 Research-status Report
- 2017 Research-status Report

Research Products (26 results)

	All	2020	2019	2018	2017
	All	Journal Article	Presentation	Patent(Industrial Property Rights)	
[Journal Article] Initial perfusate purification during subnormothermic machine perfusion for porcine liver donated after cardiac death				2020	▼
[Journal Article] Impact of Machine Perfusion on Sinusoid Microcirculation of Liver Graft Donated After Cardiac Death.				2020	▼
[Journal Article] Applicability of Hypothermic Oxygenate Machine Perfusion Preservation for Split-Liver Transplantation in a Porcine Model: An Experimental Study				2020	▼
[Journal Article] 免疫抑制剤と臓器保存 Current topics of immunosuppression and preservation for organ transplantation				2020	▼
[Journal Article] Impact of human-derived hemoglobin based oxygen vesicles as a machine perfusion solution for liver donation after cardiac death in a pig model.				2019	▼
[Journal Article] 機械灌流による代謝に着目した移植のための臓器機能評価技術、 Organ viability assessment technology using machine perfusion for transplantation.				2019	▼
[Journal Article] Oxygen consumption during hypothermic and subnormothermic machine perfusions of porcine liver grafts after cardiac death				2018	▼
[Journal Article] Current development of organ assessment method using machine perfusion for organ transplantation				2018	▼
[Journal Article] Application of Perfusate With Human-Derived Oxygen Carrier Solution Under Subnormothermic Machine Perfusion for Donation After Cardiac Death Liver Grafts in Pigs				2018	▼
[Journal Article] Evaluation Using an Isolated Reperfusion Model for Porcine Liver Donated After Cardiac Death Preserved with Oxygenated Hypothermic Machine Perfusion				2018	▼
[Journal Article] 心停止ドナーへの肝移植に対する人工赤血球（Hemoglobin vesicles, HbV）を用いた灌流保存方法の有効性				2018	▼
[Journal Article] Ex vivo reperfusion model to evaluate the utility of machine preservation for porcine liver donated after cardiac death				2018	▼
[Journal Article] The ultrastructural characteristics of porcine hepatocytes donated after cardiac death and preserved with machine perfusion preservation.				2017	▼
[Journal Article] 北海道から発信する移植医療技術；臓器灌流保存、機能再生プロジェクトについて				2017	▼
[Journal Article] 臓器機械灌流による臓器機能評価技術の新展開				2017	▼
[Presentation] Present status of transplant organ preservation by dynamic machine perfusion system: How important is the development of a novel organ preservation solution?				2019	▼
[Presentation] The efficacy of hemoglobin vesicles(HbV)containing solution in machine perfusion in donation after cardiac death(DCD) in pig liver model				2019	▼
[Presentation] 命をつなぐ移植臓器灌流保存方法における人口赤血球（HbV）含有灌流保存液の研究				2018	▼
[Presentation] 臓器機能温存に貢献する新しい医工学技術」S2-4 肝臓代謝因子に着目した室温機械灌流における移植前機能評価の基礎的検討				2018	▼
[Presentation] （小崎正巳教授メモリアルシンポジウム）「次世代の臓器保存」 S4-5 国内臨床応用に向けた臓器機械灌流保存の有効性に関する検討				2018	▼
[Presentation] The examination of perfusate with artificial oxygen carrier under subnormothermic machine perfusion for DCD liver grafts in pigs.				2017	▼
[Presentation] 長期間保存された人工赤血球による肝灌流保存液の基礎的検討				2017	▼
[Presentation] 人工赤血球含有灌流液による肝機械灌流保存の基礎的検討				2017	▼
[Presentation] 肝移植モデルを用いた人工赤血球含有灌流液での肝機械灌流保存の基礎的検討				2017	▼
[Patent(Industrial Property Rights)] CONNECTOR AND FLUID SUPPLY SYSTEM				2019	▼
[Patent(Industrial Property Rights)] 機械保存装置				2017	▼

URL: <https://kaken.nii.ac.jp/grant/KAKENHI-PROJECT-17K10503/>

Published: 2017-04-28 Modified: 2021-02-19

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胃の消化が宇宙環境に適応するメカニズムの形態学的解析

Research Project

All

Project/Area Number

20K11539

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Multi-year Fund

Section

一般

Review Section

Basic Section 59040:Nutrition science and health science-related

Research Institution

Jikei University School of Medicine

Principal Investigator

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Project Period (FY)

2020-04-01 – 2023-03-31

Project Status

Granted (Fiscal Year 2020)

Budget Amount *help

¥4,420,000 (Direct Cost: ¥3,400,000、Indirect Cost: ¥1,020,000)
Fiscal Year 2022: ¥910,000 (Direct Cost: ¥700,000、Indirect Cost: ¥210,000)
Fiscal Year 2021: ¥1,560,000 (Direct Cost: ¥1,200,000、Indirect Cost: ¥360,000)
Fiscal Year 2020: ¥1,950,000 (Direct Cost: ¥1,500,000、Indirect Cost: ¥450,000)

Keywords

宇宙医学 / 胃 / 消化 / 微小重力 / 電子顕微鏡

Outline of Research at the Start

有人宇宙活動の本格化を迎え、ヒトが宇宙で生活する基盤構築の必要性が高まっている。本研究課題では、宇宙での「食」の基礎となる胃の消化機能が、微小重力下の食物動態変化に適応するメカニズム解明を目指す。前述の目的達成のため、国際宇宙ステーションにて微小重力下で実際に飼育されたマウスの組織と、地上で模擬微小重力装置を用いて培養された組織・細胞を対象として、光顕・電顕を駆使した形態学的解析を主に実施する。本研究の成果は、既存の宇宙医学領域に新たな観点を付加し、さらには宇宙栄養生理学の領域創出の基礎となるため、今後の食品機能性を発揮する宇宙食開発の基盤形成に役立つことが期待される。

URL:

https://kaken.nii.ac.jp/en/grant/KAKENHI-PROJECT-20K11539/

Published: 2020-04-28

Modified: 2020-08-26