JSPCCS-Study Group for Cardiovascular Dev. Joint Session

Fri. Jul 10, 2026 10:40 AM - 11:40 AM JST | Fri. Jul 10, 2026 1:40 AM - 2:40 AM UTC | Room6（Room 604）

[JSCDJS-OR] 日本小児循環器学会・第25回日本心臓血管発生研究会 合同セッション（II-JSCDJS-OR）

一般口演

座長:古道 一樹(東京都立大塚病院 小児科)

座長:仲岡 英幸(富山大学 学術研究部医学系小児科講座)

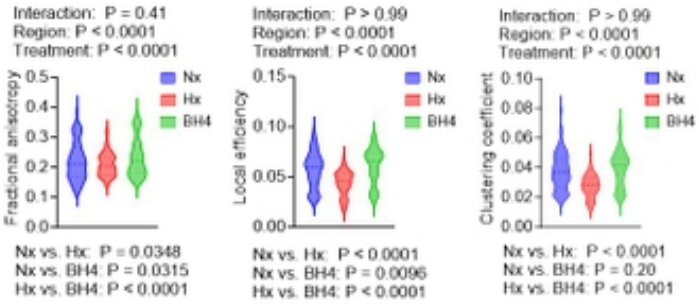
[II-JSCDJS-OR-4] テトラヒドロビオプテリン治療は低酸素が引き起こす発達段階におけるブタの脳の構造ネットワーク障害を軽減する

○Akihisa Furuta[1,2], Artur Agaronyan[1,2], Van Lam[2], Kumi Kobayashi[1,2], Kei Kobayashi[2], Stephen Lin[3], Paul Wang[3], Tsang-Wei Tu[3], Nobuyuki Ishibashi[1,2,4] (1.Anatomy and Neurobiology, Boston University, 2.Neuroscience Research, Childrens National Hospital, 3.Department of Radiology, Howard University, 4.Boston Childrens Hospital)

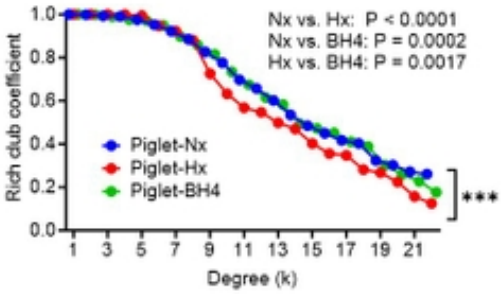
Keywords：Structural connectivity、Hypoxia、tetrahydrobiopterin

Background: Reduced oxygen delivery in congenital heart disease (CHD) causes delayed brain maturation and white matter (WM) abnormalities in utero. No treatment currently exists. We previously demonstrated that tetrahydrobiopterin (BH4) treatment during hypoxia improves WM maturation in mice. This study assessed the efficacy in the developing porcine brain.Methods: We used the piglet model of developmental hypoxia (10.5% O2, day 3 to 14) that can reproduce immature brain development seen in newborns with CHD. Nineteen piglets were assigned to control (n=7), hypoxia (n=8), or hypoxia+BH4 (n=4). BH4 was administered at 20 mg/kg/day during hypoxia. Brains were analyzed by diffusion tensor imaging (DTI) and histology on day 14.Results: DTI showed reduced fractional anisotropy (FA) in WM following hypoxia. Network analysis demonstrated hypoxia-induced reductions in local structural connectivity and alterations in rich club organization, similar to the fetus/neonate with CHD. Node-based analyses revealed impaired structural connectivity in the anterior prefrontal, insular, and primary somatosensory cortices ($P < 0.05$). Electron microscopy studies identified impairments of myelination following hypoxia. BH4 treatment during hypoxia normalized WM FA, restored hypoxia-induced network alterations, and preserved nodal connectivity in anterolateral regions.Conclusion: Given the established safety profile of BH4 and its FDA approval for use during pregnancy, these results highlight its translational potential as a prenatal intervention to improve brain maturation in fetuses with CHD.

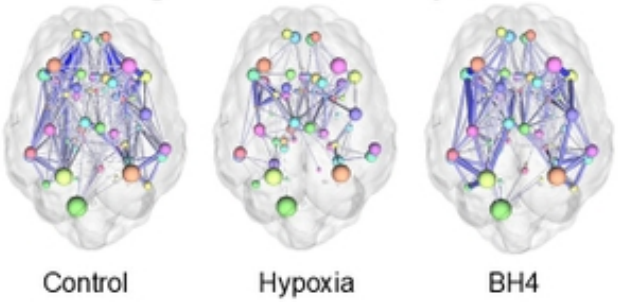
● **Local network**



● **Rich club coefficient**



● **3D image of brain connectivity**



● **Electron microscopy**