

ABSTRACT

THE EFFECTS OF VITAMIN D ON SPATIAL MEMORY FUNCTION AND NEUN mRNA EXPRESSION IN THE HIPPOCAMPUS OF TRANSIENT GLOBAL BRAIN ISCHEMIC INJURY RAT MODEL

Background: Transient global ischemic brain injury decreases the spatial memory function of the hippocampus. This phenomenon also produces apoptosis in the neuron and reduces NeuN as a marker of neuronal damage. Vitamin D, thought to have neuroprotective properties, is being investigated for potential therapeutic intervention. The study combines behavioral assessments of spatial memory function with molecular analysis of NeuN mRNA expression in the hippocampus to elucidate the effects of vitamin D.

Aim: To study the effects of vitamin D on the spatial memory function and mRNA expression of NeuN in the hippocampus of transient global brain ischemic injury rat model.

Method: This study was a quasi-experimental study with a posttest-only controlled group design using male Wistar rats with an age of 2–3 months and weighing 150–300 grams. Twenty-four rats were assigned into 4 groups (n=6): Sham-operated (SO), bilateral common carotid artery occlusion (BCCAO), BCCAO + vitamin D 0,125 µg/kgBW (VD1), BCCAO + vitamin D 0,5 µg/kgBW (VD2). Transient global brain ischemic injury was induced by BCCAO for 20 minutes and vitamin D is injected intraperitoneally once per day for 10 days until it is terminated. During termination, the hippocampus is harvested, and RNA is extracted for Reverse Transcriptase Polymerase Chain Reaction (RT-PCR). In order to evaluate the expression of NeuN, RT-PCR will be performed. To assess the spatial memory function, Morris Water Maze (MWM) test will be performed.

Result: MWM probe test was assessed on the distance traveled in the target quadrant compared to the non-target quadrant. In the BCCAO group, the distance traveled in the target quadrant compared to the non-target quadrants is not significant. Whereas in the treatment group VD1 and VD2, the distance traveled in the target quadrant is significantly longer compared to the non-target quadrants. As for NeuN mRNA expression, the group in BCCAO has a lower expression than the SO group but not significant. However, in the treatment group VD1 and VD2, the expressions are both significantly higher than in BCCAO group.

Conclusion: Vitamin D improves spatial memory, and NeuN mRNA expression in the hippocampus of transient global brain ischemic injury rat model is higher in the vitamin D treatment group compared to the BCCAO group.

Keywords: Vitamin D, transient global brain ischemic injury, spatial memory, NeuN, oxidative stress

INTISARI

EFEK VITAMIN D TERHADAP FUNGSI MEMORI SPASIAL DAN EKSPRESI mRNA NEUN PADA HIPOKAMPUS MODEL TIKUS CEDERA ISKEMIK GLOBAL TRANSIEN

Latar Belakang: Cedera otak iskemik global transien menurunkan fungsi memori spasial pada hipokampus. Fenomena ini juga menyebabkan apoptosis pada neuron dan mengurangi NeuN sebagai penanda kerusakan neuron. Vitamin D, yang diyakini memiliki sifat neuroprotektif, sedang diselidiki untuk intervensi terapeutik potensial. Studi ini menggabungkan penilaian perilaku fungsi memori spasial dengan analisis molekuler ekspresi mRNA NeuN pada hipokampus untuk menjelaskan efek vitamin D.

Tujuan: Mempelajari efek vitamin D terhadap fungsi memori spasial dan ekspresi mRNA NeuN pada hipokampus model tikus cedera iskemik global sementara.

Metode: Penelitian ini merupakan studi kuantitatif eksperimental dengan *posttest only controlled group* desain menggunakan tikus Wistar jantan berusia 2–3 bulan dengan berat 150–300 gram. Dua puluh empat tikus dibagi menjadi 4 kelompok ($n=6$): *Sham-operated* (SO), *bilateral common carotid artery occlusion* (BCCAO), BCCAO + vitamin D 0,125 $\mu\text{g/kgBB}$ (VD1), BCCAO + vitamin D 0,5 $\mu\text{g/kgBB}$ (VD2). Cedera iskemik global transien diinduksi dengan BCCAO selama 20 menit, dan vitamin D disuntikkan *intraperitoneal* sekali sehari selama 10 hari hingga dikorbankan. Saat dikorbankan, hipokampus diambil, dan RNA diekstraksi untuk *Reverse Transcriptase Polymerase Chain Reaction* (RT-PCR). Untuk mengevaluasi ekspresi NeuN, akan dilakukan RT-PCR. Untuk menilai fungsi memori spasial, uji Morris *Water Maze* (MWM) akan dilakukan.

Hasil: Uji *probe* MWM dinilai berdasarkan jarak yang ditempuh di kuadran sasaran dibandingkan dengan kuadran non-sasaran. Pada kelompok BCCAO, jarak yang ditempuh di kuadran sasaran dibandingkan dengan kuadran non-sasaran tidak signifikan. Sedangkan pada kelompok perlakuan VD1 dan VD2, jarak yang ditempuh di kuadran sasaran signifikan lebih panjang dibandingkan dengan kuadran non-sasaran. Adapun ekspresi mRNA NeuN, kelompok BCCAO memiliki ekspresi lebih rendah daripada kelompok SO tetapi tidak signifikan. Namun, pada kelompok perlakuan VD1 dan VD2, ekspresinya keduanya signifikan lebih tinggi daripada kelompok BCCAO.

Kesimpulan: Pemberian vitamin D dapat meningkatkan kemampuan memori spasial, dan ekspresi mRNA NeuN pada hipokampus tikus model cedera iskemik global transien lebih tinggi pada kelompok vitamin D daripada kelompok BCCAO.

Kata Kunci: Vitamin D, cedera iskemik global transien, memori spasial, NeuN, stres oksidatif