IOCBE 2024 Conference

The 1st International Online Conference on Bioengineering

16–18 October 2024 | Online

MDPI

Three-dimensional neuroinflammation model as an alternative for tests in neural research

Mariana P. R. Gasparotto[12], Marcelo Garrido dos Santos[12], Débora Czarnabay[12], Fernanda Muckler[12], Mayara Dias[12], Laura E. Sperling[123], Patricia Pranke[124].

[1]Hematology and Stem Cell Laboratory, Faculty of Pharmacy, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; [2]Stem Cell Laboratory, Fundamental Health Science Institute, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil; [3]Universidade do Vale do Rio dos Sinos, Faculty of Medicine, São Leopoldo, Brazil; [4]Stem Cell Research Institute, Porto Alegre, Brazil.

INTRODUCTION & AIM

The use of animal models in research is necessary for scientific advancement; however, diminishing the usage of animals is desirable. One alternative to the use of animals is three-dimensional (3D) *in vitro* models that mimic the tissue environment allowing for more reliable results. The aim of this study was to produce and validate a 3D neuroinflammation model (3DNM) as an alternative for drug testing and alternative treatment approaches.

METHODS

The hydrogel used as base of the 3DNM was produced combining 5% alginate, 4% gelatin, and 2x10⁵ PC12 cells/mL (as a neuronal model), 4x10⁵ BV2 cells/mL (microglia), 8x10⁵ C6 cells/mL (astrocyte model). Cell viability on hydrigel was evaluated by MTT assay at day 1 in culture.

To test the anti-inflammatory potential of a bioink containing decellularized spinal cord tissue and mesenchymal cells, the 3DNM was stressed with lipopolysaccharide (LPS) and incubated with the bioink for three days. Reactive oxygen species (ROS) production and lipid peroxidation were measured. IL-6, IL-10, and IL-1B were quantified by ELISA. Non-enzymatic antioxidant defenses were evaluated by the quantification of Thiols.

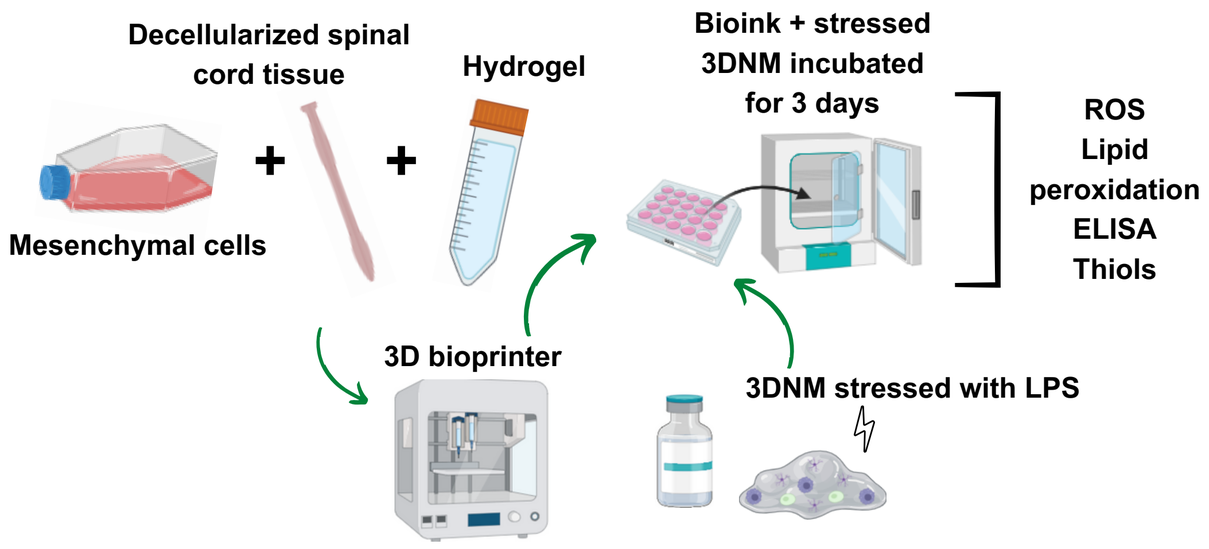

Fig. 1. Experimental design of tests with the bioink, using the 3DNM.

RESULTS & DISCUSSION

Testing the viability of the triculture system to model neuroinflammation (3DNM)

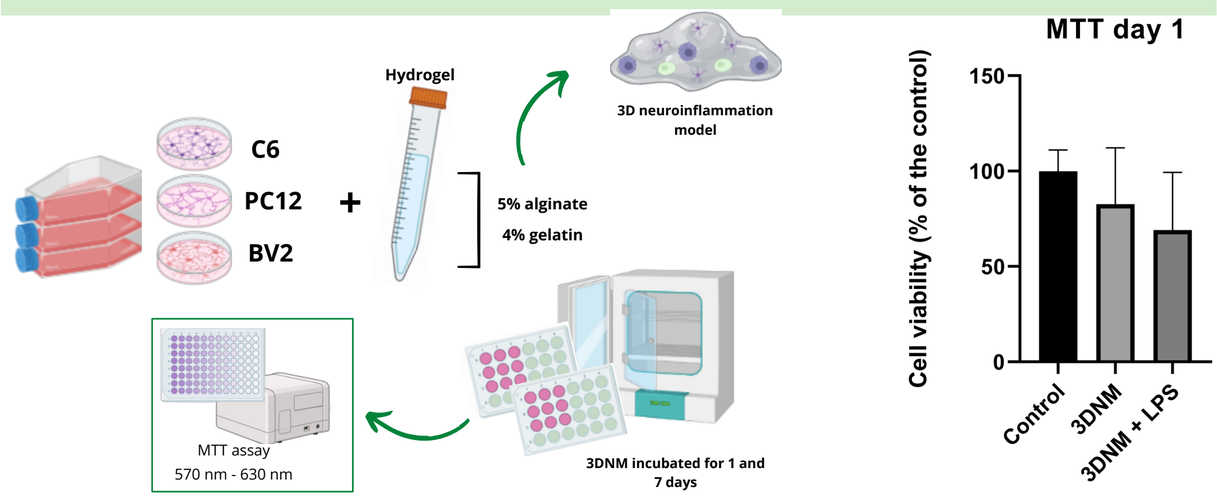

Fig. 2. A Experimental design of the 3DNM model. B. Cell viability based on MTT assay (day 1).

Oxidative stress

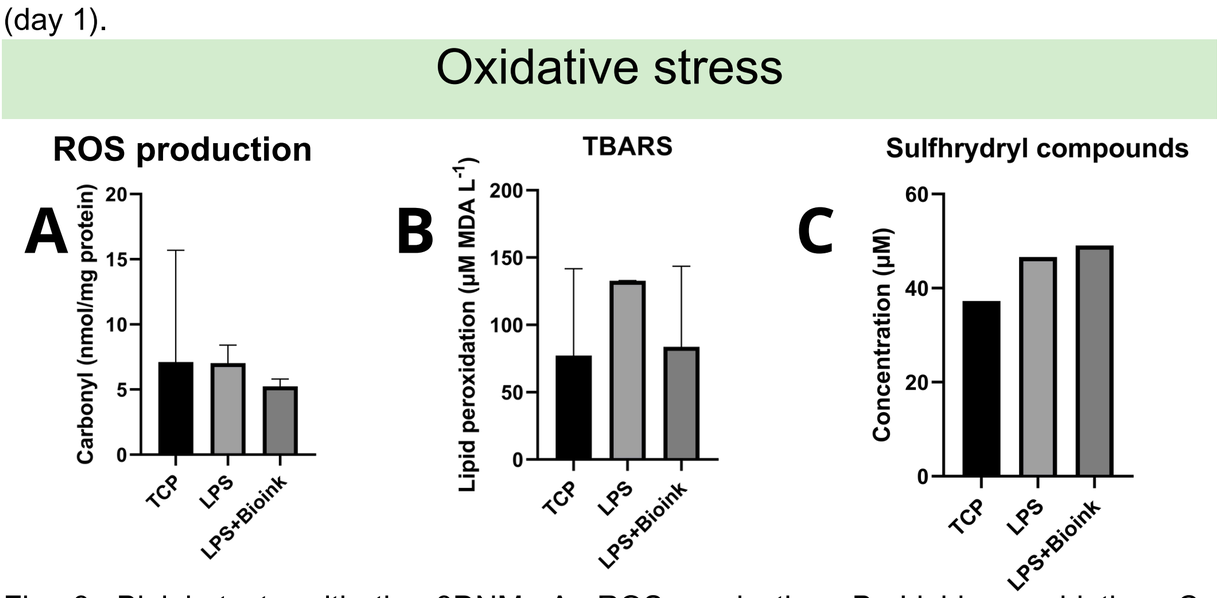

Fig. 3: Bioink tests with the 3DNM: A. ROS production; B. Lipid preoxidation; C. Sulfhrydryl compounds. N=2

Anti-inflammatory effects

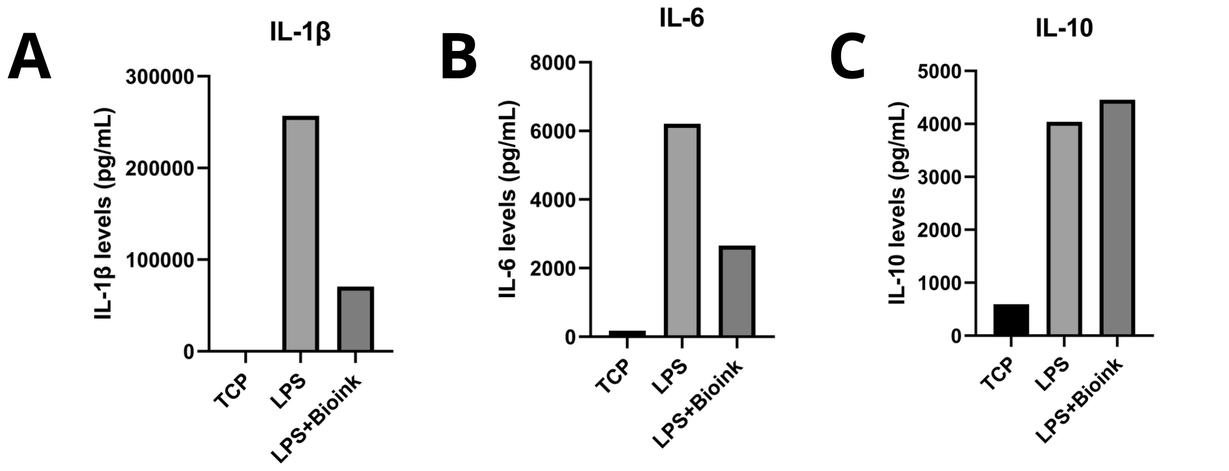

Fig. 4. Bioink tests with the 3DNM: cytokines quantification by ELISA: A. Quantification of IL-1B; B. Quantification of IL-6; C. Quantifiation of IL-10.

CONCLUSION

The 3DNM showed promising results as an alternative model to study neural inflammation. This biomaterial may, therefore, be a solution for decreasing the laboratory use of animals.

FUTURE WORK / REFERENCES

The implementation of more tests aimed at characterizing the 3DNM is the next step of the study.

Support: CNPq Finep INOVAÇÃO E PESQUISA ipct Instituto de Pesquisa com Células-tronco