

LATAR BELAKANG

Penuaan merupakan proses biologis kompleks yang menyebabkan penurunan fungsi berbagai sistem organ, peningkatan stres oksidatif, serta disfungsi mitokondria yang memicu penurunan produksi energi seluler dan mempercepat kerusakan jaringan. Kondisi ini diperburuk oleh senesensi seluler dan inflamasi kronis tingkat rendah (inflammaging), yang telah dikaitkan dengan penyakit degeneratif seperti aterosklerosis, diabetes tipe 2, dan gangguan neurodegeneratif seperti Alzheimer dan Parkinson.

Salah satu pendekatan terapi inovatif yang mulai dikembangkan untuk menangani dampak penuaan adalah terapi berbasis nanobubble, terutama yang mengandung gas hidrogen dan oksigen. Nanobubble memiliki keunggulan berupa ukuran sangat kecil (<200 nm), kemampuan tinggi dalam menembus jaringan biologis, serta kapasitas membawa gas secara efisien. Dalam konteks penuaan, terapi nanobubble menunjukkan potensi dalam meningkatkan oksigenasi jaringan, mengurangi stres oksidatif, memperbaiki fungsi mitokondria, dan menekan mediator inflamasi seperti IL-6 dan TNF- α .

Melalui pendekatan ini, terapi nanobubble diharapkan mampu memberikan efek restoratif terhadap sistem vaskular, metabolik, neurologis, dan hormonal yang terdampak oleh proses penuaan, terutama pada populasi lansia dengan kondisi neurologis akut seperti stroke iskemik. Oleh karena itu, diperlukan studi pendahuluan untuk mengevaluasi manfaat dan keamanan terapi ini secara komprehensif.

TUJUAN PENELITIAN

1. Mengevaluasi efektivitas terapi nanobubble intravena (HHO) dalam menurunkan biomarker inflamasi (IL-6, hsCRP, fibrinogen) pada pasien stroke iskemik lanjut usia.
2. Menilai perubahan pada parameter metabolik (HbA1c, eGFR, rasio albumin/globulin) dan fungsi neurologis (evaluasi kognitif dan hasil MRI otak) sebelum dan sesudah terapi.
3. Menganalisis dampak terapi terhadap modulasi hormonal (DHEA-S, testosteron bebas) dan fungsi endokrin lainnya.
4. Menilai keamanan terapi nanobubble melalui pemantauan fungsi ginjal, hati, dan elektrolit.
5. Memberikan dasar ilmiah awal untuk pengembangan terapi anti-penuaan berbasis nanobubble yang terkontrol dan terukur.

Durasi Penelitian:
2024-2025

Pendanaan:
**Reverse Aging and
Homeostasis (RAHO) Club**



INTRODUCTION

Aging is a complex biological process that leads to the decline of various organ systems, increased oxidative stress, and mitochondrial dysfunction, which contributes to reduced cellular energy production and accelerated tissue damage. This condition is worsened by cellular senescence and chronic low-grade inflammation (inflammaging), both of which are associated with degenerative diseases such as atherosclerosis, type 2 diabetes, and neurodegenerative disorders like Alzheimer's and Parkinson's disease.

One emerging therapeutic approach to mitigate the effects of aging is nanobubble-based therapy, particularly using hydrogen and oxygen gas. Nanobubbles have several advantages, including their extremely small size (<200 nm), high permeability through biological tissues, and efficient gas-carrying capacity. In the context of aging, nanobubble therapy has shown promise in enhancing tissue oxygenation, reducing oxidative stress, improving mitochondrial function, and suppressing inflammatory mediators such as IL-6 and TNF- α .

Through this approach, nanobubble therapy is expected to provide restorative effects on the vascular, metabolic, neurological, and hormonal systems affected by the aging process, especially in elderly individuals with acute neurological conditions such as ischemic stroke. Therefore, a preliminary study is needed to comprehensively evaluate the benefits and safety of this therapy.

GOALS

1. To evaluate the effectiveness of intravenous nanobubble (HHO) therapy in reducing inflammatory biomarkers (IL-6, hsCRP, fibrinogen) in elderly patients with ischemic stroke.
2. To assess changes in metabolic parameters (HbA1c, eGFR, albumin/globulin ratio) and neurological functions (cognitive evaluation and brain MRI results) before and after therapy.
3. To analyze the impact of the therapy on hormonal modulation (DHEA-S, free testosterone) and other endocrine functions.
4. To evaluate the safety of nanobubble therapy by monitoring kidney, liver, and electrolyte function.
5. To provide initial scientific evidence for the development of well-controlled and measurable nanobubble-based anti-aging therapies.

Research Duration:
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Funding:
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