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Investigating the effect of energy deficits on impairing immune function for myalgic encephalomyelitis/ chronic fatigue syndrome (ME/CFS)

Introduction

Myalgic Encephalomyelitis (ME), commonly referred to as Chronic Fatigue Syndrome (CFS), is targeted by many medications intended to rejuvenate bodily systems, albeit they cannot directly replenish energy nor provide a viable cure. For example, amphetamines or antidepressants may be used to alleviate symptoms of ME/CFS. ME/CFS is characterised by extreme fatigue, post-exertional malaise (PEM), cognitive dysfunction and more, which collectively diminish a patient's quality of life. Mitochondrial dysregulation, causing energy deficits, can obstruct the production of cellular energy, which further impairs immune function in individuals with ME/CFS. Similarly, immune processes may be linked to ME/CFS as mitochondrial dysfunction is a hallmark of senescence and exhaustion.

Impact of mitochondrial dysfunction on ME/CFS

Mitochondrial dysfunction is becoming increasingly recognised as one of the causes behind ME/CFS. The main reasons for this occurring are a partial blockage to the protein sites (translocator sites), and a lack of substrates to the mitochondria, which reduces ATP production.

- In a study consisting of 138 patients diagnosed with ME/CFS, all exhibited mitochondrial dysfunction, correlating with the severity of ME/CFS they experienced.
- Despite evidence overwhelmingly suggesting that mitochondrial dysfunction contributes to energy deficits experienced in patients, there is a lack of standardisation in current research, meaning its role in ME/CFS progression is not fully understood.

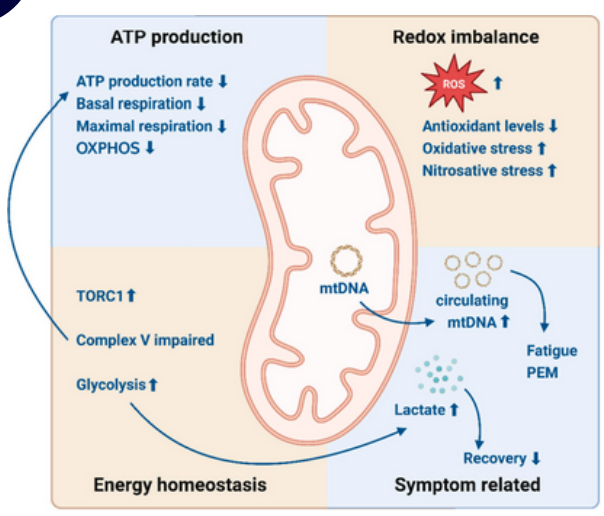

Figure 1: A diagram communicating the metabolic process of mitochondrial dysfunction in ME/CFS.

Immune senescence

This involves immune cells losing their ability to replicate, often due to ageing, which is also linked to chronic insomnia and stress. These features are common amongst ME/CFS patients, hence they suggest a connection between the energy deficit patients experience, and ME/CFS prevalence.

Both work to decrease functionality and alter surface receptors. However, inconsistent findings limit the extent to which the detection of immune senescence/ exhaustion may be utilised as an effective biomarker for ME/CFS.

Immune exhaustion

This involves the loss of lymphocyte activity, such as of T cells and B cells, which are required to defend the body from infections. It arises from long-term activation, including cancers. One study suggests a genetic predisposition to this, due to a risk allele variant of CTLA-4 found in ME/CFS patients.

Conclusion

To summarise, ME/CFS develops from a myriad of causes, one being mitochondrial dysfunction. There is ultimately a connection between the energy deficit as a result of mitochondrial dysfunction and metabolisms, regarding immune senescence & exhaustion. Despite this, there are inconsistencies amongst studies, suggesting this connection must be researched at a greater depth to conclude whether immune senescence/exhaustion are biomarkers for ME/CFS.

References

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