LONG COVID EXPLAINED

THE SCIENCE BEHIND THE SYMPTOMS

VIRAL PERSISTENCE [1,2,3,4]

Significant evidence of persistent SARS-CoV-2 has been found in the gut and immune privileged sites of Long Covid patients. Researchers also recently discovered spike protein circulating in the blood of patients which suggests an active viral reservoir is present. Covid specific T-cells were also identified as elevated in Long Covid patients months after infection. This persistence of SARS-COV-2 may be causing a cascade of other symptoms.

How many does it affect?

Current estimates suggest 10-30% of adults will experience some form of Long Covid after infection. A similar proportion of children suffer from the condition with a recent meta-analysis stating the prevalence was 25.4%. Evidence suggests the risk of Long Covid increases after multiple infections. [5,6,7,8]

MICRO BLOOD CLOTS [9,10,11]

Micro-thrombi have been detected in Long Covid patients alongside hyperactivated platelets and increased markers for coagulable (sticky) blood. These clots can block micro blood vessels and prevent oxygen exchange. Circulating spike protein (from SARS-COV-2) has been shown to trigger the formation of these micro clots. To add to this, the clots can disrupt the inner lining of blood vessels leading to endothelial dysfunction, causing poor circulation.

AUTO-IMMUNITY [12,13,14]

The immune system is chronically activated in many patients. Increased cytokines cause inflammation while a condition called MCAS increases sensitivity to histamine resulting in allergy symptoms. Auto-immunity plays a significant role. The main culprits are GCPR autoantibodies which reduce blood flow. Molecular mimicry may also be a factor, where the immune system continues its attack due to similarities between viral and human proteins.

76% of Long Covid cases occur after a mild acute Covid infection. [36]

How does it feel?

Many patients do not communicate the severity of their symptoms because of gaslighting, for social ease or they're simply unable to. Symptoms and their severity can vary from day to day but are often debilitating. A few include: mental and physical exhaustion, cognitive dysfunction, muscle pains and cramping, sensitivity to sound and temperature, nerve pain and numbness, feeling flu-like and many more. A hallmark symptom is Post-exertional Symptom Exacerbation (PESE) where symptoms worsen for hours, days or months, after mental or physical over-exertion. [15]

COGNITIVE DYSFUNCTION [16,17,18]

Cerebral hypoperfusion (reduced blood flow), impaired glymphatic drainage and elevated neural immune activity have been well documented in Long Covid and contribute to impaired cognition. Neurotoxic peptides produced by SARS-CoV-2 can also provoke neurological symptoms. Finally, researchers have found the virus can cause sustained microglial reactivity and CCL11 elevation in a similar mechanism to the chemo brain fog phenomenon.

OTHER FACTORS

RE-ACTIVATED PATHOGENS

Another potential driver of some peoples' Long Covid symptoms is re-activated pathogens. For instance, latent viruses like EBV and herpes viruses have been found to reactivate after infection with SARS-COV-2. [19,20]

CONNECTIVE TISSUE DEGRADATION

Viral infection, autoantibodies against connective tissue and MCAS (All reported in Long Covid) can weaken the body's connective tissue. This can lead to structural neurological issues such as brain stem compression, spinal stenosis and tethered cord. [21,22]

Is it new?

Yes and No, SARS-COV-2 is a novel virus with specific long term effects. However, post infection diseases are common. For example, a proportion of patients suffered with similar symptoms to Long Covid after the SARS outbreak in 2003. In addition Long Covid can closely resemble ME/CFS and Lyme disease, both of which often follow viral or bacterial infection. [23,24,25]

DYSAUTONOMIA [26,27,28]

A large study found that 67% of those with Long Covid develop a condition called dysautonomia which disrupts the autonomic nervous system resulting in difficulty regulating heart rate and blood pressure. The condition is associated with small fibre neuropathy, brain stem signalling abnormalities and reduced blood flow. SARS-COV-2 preferentially infects nervous tissue.

ENERGY PRODUCTION [29,30,31]

The kynurenine pathway (which is vital for the production of cellular energy, regulating the immune system and cognition) has been found to be disrupted in Long Covid. Furthermore researchers have repeatedly found that mitochondria (the energy producing part of cells) are dysfunctional which may account for the systemic fatigue seen in many Long Covid patients. Researchers have also demonstrated how persistent pathogens similar to SARS-CoV-2 can hijack host cell metabolism and steal the body's energy.

DYSBIOSIS [32,33,34,35]

The gut lining may be damaged in Long Covid allowing bacteria, fungi and antigens to leak into the bloodstream.

Another common finding is dysbiosis, an imbalance of the micro biome/virome (vital to maintaining health). This imbalance may perpetuate illness and be favourable to pathogens. In addition, certain gut bacteria may continue to produce toxins post covid.

References: [1] Swank et al., 2022 [Preprint], [2] Chertow et al., 2021 [Preprint], [3] Littlefield et al., 2022, [4] Goh et al., 2022 [Preprint], [5] Ceban et al., 2022, [6] CDC, 2022 [Online], [7] Lopez-Leon et al., 2022, [8] Al-Aly et al., 2022, [9] Grobbelaar et al., 2021, [10] Pretorius et al., 2021, [11] Charnley et al., 2022, [12] Hohberger et al., 2021, [13] Weinstock et al., 2021, [14] Nunez-Castilla et al., 2022, [15] Davis et al., 2021, [16] Charnley et al., 2022, [17] Fernández-Castañeda et al., 2022, [18] Lee et al., 2022, [19] Peluso et al., 2022 [Preprint], [20] Proal et al., 2021, [21] Wang et al., 2021, [22] Bragée et. al., 2020, [23] Choutka et al., 2022, [24] Bond et al., 2021, [25] Moldofsky et al., 2011, [26] Larsen et al., 2022, [27] Novak et al., 2022, [28] Burks et al., 2021, [29] Cysique et al., 2022 [Preprint], [30] Díaz-Resendiz et al., 2021, [31] Proal et al., 2021, [32] Giron et al., 2022, [33] Yonker et al., 2021, [34] Giannos et al, 2022, [35] Brogna et al., 2022 [Preprint], [36] FAIR Health, 2022 [online].

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