In Our Time: There is a Wide Variety of Ground-Breaking Approaches Becoming Approved for the Treatment of Multiple Sclerosis

In a rather pessimistic way, when I began to write this essay, all I could think of was the negative things which are apparent ‘In Our Time’: Coronavirus, racism, global warming…etc. Reading the news has become more and more challenging as it seems to highlight all of the worst things currently occurring; On the contrary, I want to highlight to you one of the many positive things happening which go largely unrecognised: the positive strides being made in our time to be able to effectively treat multiple sclerosis. I chose this matter in particular not only because of its personal connection to my family but also the 2.3 million people who are diagnosed with it globally, whose lives are changing alongside the innovative new treatments.

Multiple Sclerosis (MS) is a disease which attacks the central nervous system (CNS), based in the spinal cord and brain, contained within the vertebral canal and skull. There is also a peripheral nervous system (PNS) but multiple sclerosis only attacks the CNS, which contains roughly 86 billion neurons that allow us to perform important life processes such as movement, sensitivity, response and excretion. There are three major types of neurons: sensory, motor and interneuron; they are all made up of a cell body and an axon, most of which are protected by a myelin sheath. The axon is an extension of the cell body which carries the messages instructing your body what to do, this is vital and thus the body has evolved to keep it protected by myelin, a substance rich in lipids and proteins, used for insulating the axon in order to conserve nerve transmission. Myelin first evolved during the Ordovician period (444 million years ago) and has been crucial ever since. Now I have explained how important this myelin is, you can understand why multiple sclerosis is so harmful, as its primary attack is upon destroying the myelin in the central nervous system. This attack stems from an error in the immune system, meaning that the immune system mistakenly attacks a healthy part of the body; making MS known as an autoimmune disease. Myelin in the CNS is produced by cells called oligodendrocytes; this in fact, is just one of many things which makes MS so unique, as there is additional myelin protecting neurons in the peripheral nervous system (the myelin there is produced by Schwann cells) which is not impacted by the disease. These complexities can impact people in various ways.

As I mentioned, the oligodendrocyte myelin is imperative in sustaining nerve transmission throughout the central nervous system and multiple sclerosis destroys this, therefore impairing nerve transmission. How does this actually effect patients in their everyday lives though? In the worst cases, sufferers are left in wheelchairs because their muscles become very weak and it is difficult to balance. Additionally, the flawed nerve transmission can cause issues with immunity, vision, breathing, swallowing, coordination, brittle bones and even ‘thinking’ which sounds vague, but is meaning forgetfulness or confusion. These are also the sort of symptoms that are experienced during a relapse. Sadly, multiple sclerosis is currently irreparable, a cure would be constituted by a way to stimulate oligodendrocytes to produce more myelin, which has proven difficult.

Luckily there is a multitude of treatments available which aim to reduce the impacts of multiple sclerosis. There are four dominant phenotypes of the illness: relapsing, primary progressive, secondary progressive and clinically isolated syndrome; this is classified depending on the activity of the disease in your body - it affects everyone differently.

To understand the context of the current treatments, you must know that the most prevalent form of MS works in a way that causes relapses and remissions, which is much different from other diseases and just another thing which makes this one so unique. This is known as ‘relapsing remitting multiple sclerosis’ (RRMS). At the moment, this is the only kind of MS which can be treated in mainstream medicine. Each relapse recovery will become less complete over time, eventually leaving you with worsening disability; though it is not all bad! This stage is generally only reached if the disease goes untreated which alongside our progressive healthcare system, is very rare.

This leads me to the first form of treatment: short courses of steroid medicine aimed to make symptoms less ruinous during a relapse. These steroid medicines are administered via tablets or injections in order to efficaciously reduce the hardship, through its anti-inflammatory properties and reducing the activity of the immune system. This is helpful to people with MS because it is specifically the immune system which aggressively attacks the myelin during relapses. However, these steroids do not constitute a long-term treatment, as the relapses will continue to occur because during remissions, the disease is still actively attacking the central nervous system; doctors did not always know this, they previously assumed that as long as relapses were treated, all would be well. This misconception was resolved after a study done in 1988.

In order to treat this in the long term, a method known as ‘Disease Modifying Therapy’ is used. This intends to reduce the number and seriousness of relapses in the long term and is done by constantly interacting with the immune system, inhibiting antigen presentation and promoting a shift of focus from T helper 1 cells to T helper 2 cells. This is helpful because it lessens activity in the immune system and inflammation over a long duration. This is almost always used to treat RRMS, although in October 2018 a disease modifying drug called Ocrelizumab was approved by the NHS to treat primary progressive MS; this is the only long-term treatment approved so far for a form of MS other than relapsing-remitting. These disease modifying therapies are relatively simple to administer and done via tablets, injections or infusions.

The final treatment which is considered a part of mainstream medical care is Haematopoietic stem cell transplantation (HSCT). Treatment involving stem cells is a hugely exciting area of research and is used in all sorts of medical treatments because of the stem cells unspecialised properties and ability to renew themselves. HSCT treatment uses chemotherapy and a strain of stem cell found in bone marrow called Haematopoietic stem cells, aiming to wipe out the immune system and ‘reset’ it to bar it from attacking the central nervous system. HSCT is much more complex to conduct in comparison to the 2 aforementioned treatments. Firstly, stem cells are extracted, then chemotherapy is performed on the patient to wipe out their immune system whilst the stem cells are treated and restored to fight off multiple sclerosis attacks, finally the stem cells are reintroduced followed by a period of isolation to give the treatment its best chance to work. Due to the complexity and aggression of this treatment it is only used in severe cases which meet specific criteria.

Finally, there is a range of more holistic approaches. These range from acupuncture to even the use of medical marijuana which although controversial, was recently approved by the NHS to treat some of these incurable, debilitating diseases.

These treatments are all relevant but not comparable to a new treatment which has just been discovered by researchers and is expected to become approved for use within the next 5 years…

This new treatment could transform treatment for patients with multiple sclerosis. It is actually a drug already used by the NHS for type 2 diabetes called *Pioglitazone*. In late 2019 scientists discovered that this drug would be helpful to treat multiple sclerosis after trials done on mice and rat brains identified restorative properties in the medication. This attribute is highly sought after in MS treatment research because unlike the treatments at present, it could not only halt progression of the disease, but also reverse damage which has already been done; due to this, researchers have referred to this as a “holy grail”. This discovery was announced by The MS Society - a leading charity aiding with treatment advancements in *Cell Stem Cell*, a peer reviewed journal specialising in biological advancements. The leader of the research is Robin Franklin who is the director of the MS Society Cambridge Centre for Myelin Repair and the next step will be conducting human trials. In pursuance of this, the MS society has begun a fundraising appeal for £100 Million to ‘accelerate research’. Excitingly, due to the nature of this treatment, it would be affectively used in all different types of multiple sclerosis which has never been found before.

The science behind this phenomenon is actually relatively simple. The restorative properties in this medicine derive from a natural mechanism found in the body which is the nerves response to myelin damage in which there is an increase in the movement of mitochondria; it is being referred to as *axonal response of mitochondria to demyelination.* This response has been found to be boosted by the Pioglitazone medication, therefore promoting the restoration of myelin fibres which are hurt at the centre of the disease. This was found after using Pioglitazone in adult rodent oligodendrocyte progenitor cells (OPCs). In drastically demyelinated regions of multiple sclerosis there is a lack of these OPCs which is why remyelination is so difficult; therefore, substances which can hyper-stimulate this small amount of OPCs will decidedly improve remyelination, meaning that axons become better protected and efficient nerve transmission is restored. So far this has only been proven in rodent oligodendrocyte progenitor cells (which are similar to human OPCs), but hopefully in the human clinical trials the same thing can be shown.

If you don’t suffer from multiple sclerosis yourself, I’m sure you can still comprehend the impact that this new treatment would have upon your life, particularly in the context of the fact that other types of MS besides relapsing-remitting have never before had such promising treatment prospects. I sat down with a sufferer of this disease to try and further understand what it’s like. When I displayed the research and my essay to this person-the best way to describe her reaction is elation. She began to describe to me the turmoil and confusion surrounding the time that she was diagnosed; she was in fact in the United States at the time with a totally foreign healthcare system (which you have to pay for!!) and recalled how scary it is being told that there may never be a treatment for this condition and you just have to watch it progress. This additionally highlighted to me the relevance of this treatment in our time, as we are so fortunate to have the NHS who are at the forefront of providing the newest and best treatments to everyone. After chatting with just one out of 2.3 million MS sufferers worldwide, I can already see the great impact this will have on each and every one of those people’s lives.

In conclusion, I thoroughly enjoyed exploring the context, impact and functions behind this new scientific development. I really believe that it can become approved soon – as long as awareness is raised – and subsequently change the lives of those affected and their families.

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