MEDG 505: Final Assessment

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Statement: "Given the current state of the technology, be it resolved that somatic cell gene editing for disease causing variants is ethically permissible in clinical applications."

Due: Monday, April 6th, at 9:00 AM

Pros

- Somatic cell gene editing to fix disease-causing variants can drastically improve the quality of life for those with the disease. This can increase general well-being of the individual (e.g. mental health, social wellness, etc.) as well as their friends/family. With better quality of life for these individuals, the suicide and euthanasia rates should decrease. Overall, there should be less suffering for all individuals (and friends/family members) involved. Additionally, in the case of genes with variants that have disease-protecting variants (i.e. alleles that may protect against a disease), somatic cell gene editing can actually go beyond restoring the wildtype phenotype.
- Somatic cell gene editing effects will not be propagated to offspring. Off target effects and other unintended side effects, if there are any, will be restricted to that individual receiving the somatic cell gene editing. This leaves room for clinical trials and improvement on the technology without the fear of severely affecting future generations.
- While somatic cell gene editing has its cons, these cons are also present for the current state of pharmaceuticals and drug treatments, which have become the standard of care. Drugs have unintended side effects, just like somatic cell gene editing can have off target effects, and can be very expensive and unaffordable. These issues are prevalent, and often the solution is to merely keep a delicate balance, where the advantages may only slightly outweigh the disadvantages.

Cons

- As with most novel medical techniques and treatments, the upper class will have easier access to somatic cell gene editing through the private healthcare system. While the upper class can pay their way through to treatment in the private sector, the lower class may be put on a waitlist for years waiting for treatment in the public sector. Novel treatments for rare or disease-causing variants are often very expensive, and will not be affordable to the lower class as the treatments may not be covered by universal healthcare insurance. If multiple rounds are required (which is usually the case), it may be out of reach for much of the lower class who also need it.
- Somatic cell gene editing can cause off target effects. Due to the off target activity of the RNA guided endonuclease used in somatic cell gene editing, disruptions and mutations in other genes may be introduced (e.g. indels). Somatic cell gene editing uses native DNA repair mechanisms, where introducing a double stranded break in DNA can be lethal if repaired improperly. In addition to off target effects, gene products are often involved in many pathways, some understood and others still unknown, leading to unintended effects from somatic cell

gene editing. It is also possible that off-target effects are not immediately observed, and may manifest years down the line, or long-term effects that are still unknown.

- Somatic cell gene editing is only a temporary fix to mitigate the disease phenotype. The effect of the somatic cell gene editing often lasts a few months depending on the half-life of the gene product, where multiple rounds of treatment, or perhaps consistent, lifetime treatment, may be required.

Concluding Remarks

- At the current state of our technology, as well as our legal and ethical frameworks, somatic cell gene editing should only be used as a last resort in the cases of debilitating disease-causing variants, as off-target effects are still being studied.
- It is very often that the legal and ethical frameworks cannot keep up with the rate that technology is advancing, so somatic cell gene editing should not be the standard of care just yet, not until our frameworks are updated to keep the chaos in check and ensure that we do not descend into a dystopian society.
- Additionally, there should be equal access to treatment across the various classes via coverage from universal healthcare implementations.