

Gene Editing: Nursing Role and Care

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Abstract

Gene editing is a revolutionary technology that has the potential to treat genetic disorders and even cure some diseases. The CRISPR/Cas9 system is the most widely used gene editing tool due to its precision and efficiency. However, with any new technology comes potential risks and ethical concerns. Recent studies have shown that the CRISPR/Cas9 system can result in off-target effects, raising concerns about unintended consequences. In addition, the potential for eugenics and discrimination is a significant ethical concern surrounding gene editing. There is also a concern that the technology could be used to create "designer babies" with enhanced traits, which could exacerbate social inequalities (Lander et al., 2019). Despite these controversies, gene editing is showing promise in treating cancer, genetic disorders, and HIV. Nurses will play an important role in educating patients and families about the potential risks and benefits of the technology. Additionally, nursing care for patients undergoing gene editing may include monitoring for adverse effects, providing emotional support, and assisting with the informed consent process. It is essential for nurses to stay up-to-date with the latest research and ethical considerations surrounding gene editing to provide the best care for their patients. While gene editing has the potential to revolutionize medical treatment, it is essential to proceed with caution and consider the potential risks and ethical implications. By staying informed and vigilant, we can ensure that the benefits of gene editing are realized while minimizing the potential risks. This paper will review the current developments and applications of gene editing, as well as the ethical implications and regulatory challenges associated with its use.

Introduction

Gene editing is a rapidly advancing field of biotechnology that allows for the precise manipulation of genetic material. It has the potential to revolutionize medicine, agriculture, and environmental management. While gene editing offers significant benefits, such as the potential to cure genetic diseases and enhance food security, it also raises ethical concerns about the safety, equity, and social implications of these technologies (Gupta et al., 2019). This paper will review the current developments and applications of gene editing, as well as the ethical implications and regulatory challenges associated with its use.

Current Application

Gene therapy clinical trials are currently underway to explore the potential of gene editing in the treatment of cancer, genetic disorders, and HIV. These trials involve the use of various gene editing techniques such as CRISPR-Cas9, zinc finger nucleases, and TALENs to target and correct genetic mutations associated with these diseases (National Institutes of Health, 2021).

For instance, CRISPR-Cas9 has shown promising results in treating sickle cell anemia, a genetic blood disorder that affects millions of people worldwide. A study by Cho et al. (2017) demonstrated the effectiveness of CRISPR-Cas9 in targeting and correcting the genetic mutation responsible for sickle cell anemia. Another study by Gaj et al. (2016) explored the potential of CRISPR-Cas9 in treating genetic disorders such as cystic fibrosis and Huntington's disease. Furthermore, gene editing is showing promise in treating cancer, and HIV. In a study published in 2019, researchers successfully used CRISPR/Cas9 to cure a patient of HIV (Gupta et al., 2019). In fact, the gene editing technique CRISPR-Cas9 can be used to disrupt or remove genes

that promote tumor growth or to introduce genes that inhibit tumor growth. By targeting cancer-specific genes, gene editing can potentially provide a more effective treatment option that is tailored to the individual patient's cancer (Sánchez-Rivera et al., 2015).

Another area where gene editing has the potential to revolutionize healthcare is in the development of personalized medicine. By using gene editing techniques to modify a patient's DNA, it is possible to create personalized treatments that target specific genetic mutations that are unique to that patient (Mojica, 2018). This approach has the potential to increase the efficacy of treatments while minimizing side effects.

Side Effects

Gene editing holds great promise for treating a wide range of diseases, but there are also concerns about its potential side effects. Some of the potential side effects of gene editing include unintended off-target effects, immune reactions, and the possibility of introducing new genetic mutations (Cyranski, 2017).

Unintended off-target effects occur when the gene editing process targets unintended regions of the genome, leading to unintended changes in DNA. This can result in unintended changes in gene function and potentially harmful effects (Bubela et al., 2018).

Immune reactions are another potential side effect of gene editing. When foreign DNA is introduced into the body, the immune system may recognize it as a threat and trigger an immune response, potentially leading to inflammation and other adverse effects (Cyranski, 2017).

Finally, the introduction of new genetic mutations is also a concern with gene editing. While the goal of gene editing is to correct genetic mutations, there is a risk that new mutations

may be introduced during the gene editing process, potentially leading to new health problems (Bubela et al., 2018).

In summary, while gene editing holds great promise for treating a wide range of diseases, there are also potential side effects that must be carefully considered. Unintended off-target effects, immune reactions, and the introduction of new genetic mutations are among the potential risks associated with gene editing. Further research and careful monitoring of patients undergoing gene editing therapy are necessary to ensure the safety and efficacy of this technology.

Ethical Concerns

However, despite the potential benefits of gene editing, there are concerns about the potential risks and ethical implications of this technology. Some experts have raised concerns about the potential for gene editing to create unintended consequences and unforeseen risks (Bubela et al., 2018). There are also ethical concerns about the use of gene editing for non-therapeutic purposes, such as genetic enhancement, which raises questions about fairness and social justice (Baylis, 2017). Recent studies have shown that the CRISPR/Cas9 system can result in off-target effects, where the system cuts the DNA at unintended locations, raising concerns about unintended consequences (Barrangou & Doudna, 2016). In addition, the potential for eugenics and discrimination is a significant ethical concern surrounding gene editing. There is also a concern that the technology could be used to create "designer babies" with enhanced traits, which could exacerbate social inequalities (Lander et al., 2019).

Nursing Role and Care

Given these concerns, it is crucial to involve healthcare professionals, including nurses, in the development and implementation of gene editing therapies. As gene editing becomes more prevalent, nurses will play an important role in educating patients and families about the potential risks and benefits of the technology (Keohane et al., 2021). Additionally, nursing care for patients undergoing gene editing may include monitoring for adverse effects, providing emotional support, and assisting with the informed consent process (Dodge et al., 2020). It is essential for nurses to stay up-to-date with the latest research and ethical considerations surrounding gene editing to provide the best care for their patients.

Nurses can play a vital role in monitoring and managing the potential side effects of gene editing therapies such as; targeting unintended regions of the genome, immune reactions, and new genetic mutations. According to Cyranoski (2017), one of the critical responsibilities of nurses is to monitor patients for any adverse effects of gene editing therapies and report any findings to healthcare providers promptly. Nurses can monitor patients for signs and symptoms of immune responses, such as fever, rash, and difficulty breathing, and report these to the healthcare team. manage the symptoms of immune reactions include administering anti-inflammatory medications and managing pain and discomfort. In addition, nurses can help educate patients about potential side effects and provide them with emotional support during the treatment process. Moreover, nurses can assist in the development and implementation of supportive care strategies to manage the side effects of gene editing therapies. These strategies can include pharmacological interventions, nutritional support, and psychosocial interventions (Cyranoski, 2017). For example, nurses can administer medications to manage pain and nausea, provide nutritional support to prevent malnutrition, and offer counseling and other psychosocial interventions to alleviate anxiety and depression.

As Dzau et al. (2015) emphasized, interdisciplinary collaboration is essential in healthcare, and nursing practice should be guided by ethical principles such as respect for autonomy, beneficence, non-maleficence, and justice when dealing with gene editing therapies. Moreover, ongoing monitoring and evaluation of gene editing therapies are necessary to ensure patient's safety and efficacy (Cyranoski, 2017).

Conclusion

Gene editing technology has the potential to revolutionize medical treatment by providing more precise and effective therapies for various diseases. However, it is important to proceed with caution and consider the potential risks and ethical implications associated with the use of this technology. As nurses, we play a critical role in the safe and effective implementation of gene editing therapies. We can do this by staying informed of the latest developments in the field and educating our patients about the potential benefits and risks of gene editing. Additionally, we can monitor patients for any adverse effects of gene editing therapies and provide emotional support to them during the process. As the field of gene editing continues to rapidly evolve, it is essential that we remain vigilant and prioritize patient safety and ethical considerations in our practice (De Miguel Beriain et al., 2020).

Furthermore, nurses can also advocate for ethical decision-making in gene editing by engaging in discussions with healthcare providers and policymakers on the potential ethical dilemmas of using gene editing therapies. We can also promote the importance of informed consent and the rights of patients to make decisions regarding their healthcare. Moreover, nurses can contribute to the development of guidelines and policies for the responsible use of gene editing technology. By actively participating in the ethical discourse surrounding gene editing,

nurses can ensure that the technology is used in a manner that is safe, ethical, and respects the dignity and autonomy of patients (De Miguel Beriain et al., 2020).

In summary, gene editing is a rapidly advancing field with significant potential for improving patient outcomes. Nurses have an essential role to play in ensuring the safe and ethical implementation of gene editing therapies. By being informed, vigilant, and engaged in ethical discussions, nurses can help to shape the responsible use of gene editing technology and provide the best possible care for their patients.

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