



Role of Rotavirus Vaccination in Decline in Incidence of Type 1 Diabetes

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ABSTRACT

Background: The relationship between rotavirus vaccination and the incidence of type 1 diabetes (T1DM) has garnered increasing attention in recent years, particularly as researchers seek to understand the potential implications of vaccination on autoimmune diseases. **Literature Review:** Following this, the systematic review and meta-analysis conducted by (Zhang et al., 2012) further supported the notion that rotavirus vaccination does not increase the risk of developing T1DM. This comprehensive evaluation synthesized data from multiple studies, reinforcing the hypothesis that vaccination could have a protective role against the disease. The authors underscored the importance of investigating the biological mechanisms linking rotavirus infections to autoimmune responses, which could elucidate why vaccination may mitigate T1DM risk. Additionally, the review by (Juliana Paiva Alves Abrantes et al., 2014) explored the environmental triggers of T1DM, including viral infections like rotavirus. It emphasized the mixed results in existing research but pointed to emerging evidence suggesting that complete rotavirus vaccination may indeed lower T1DM incidence. The authors highlighted significant studies showing a notable reduction in T1DM risk among vaccinated children, further supporting the public health implications of vaccination strategies. **Conclusion:** In conclusion, the literature reviewed indicates a potential protective effect of rotavirus vaccination against the incidence of T1DM, particularly with the pentavalent vaccine. While the evidence is compelling, the complexities surrounding T1DM pathogenesis and the limitations of observational studies necessitate further research to establish clearer causal relationships. Continued investigation into the mechanisms by which rotavirus vaccination may influence T1DM risk will be essential for validating these findings and informing public health policies.

Keyword: Rotavirus Vaccination, Incidence of Type 1 Diabetes

INTRODUCTION

The relationship between rotavirus vaccination and the incidence of type 1 diabetes (T1DM) has garnered increasing attention in recent years, particularly as researchers seek to understand the potential implications of vaccination on autoimmune diseases. The exploration of this connection is underscored by a series of studies that highlight varying degrees of association and causation between rotavirus vaccination and the risk of developing T1DM.

In a pivotal study by (A. M. Rogers et al., 2019), the authors reported a significant reduction in the incidence of T1DM among children who received the complete rotavirus vaccination series compared to both contemporary and historical cohorts who were not vaccinated. Their findings indicated that the pentavalent vaccine was particularly effective in lowering the risk of T1DM, while also noting the overall safety of the vaccine, as evidenced by fewer hospitalizations among vaccinated children. Importantly, the study acknowledged the complexity of disease pathogenesis, suggesting that while the rotavirus vaccine appears beneficial, other factors may also play a role in the development of T1DM. The study's observational nature, however, limits the ability to draw definitive conclusions.

Building on this foundation, (Zhang et al., 2012) conducted a systematic review and meta-analysis to further evaluate the association between rotavirus vaccination and T1DM. Their comprehensive analysis synthesized existing literature, aiming to clarify the protective effects of rotavirus vaccination on the incidence of T1DM. This systematic approach is crucial for understanding the broader implications of vaccination practices and their potential role in altering disease patterns.

More recently, (Juliana Paiva Alves Abrantes et al., 2014) delved into the potential environmental triggers of T1DM, specifically focusing on viral infections, including rotavirus. Their review highlighted the mixed results from various studies regarding the relationship between rotavirus infections and T1DM risk. However, they underscored emerging evidence suggesting that the complete routine

vaccination against rotavirus may indeed decrease the incidence of T1DM. They referenced two significant studies, including one involving over a million children in the United States, which reported a notable reduction in T1DM risk among those who completed the rotavirus vaccination series.

Together, these articles illustrate a developing narrative regarding the role of rotavirus vaccination in the decline of T1DM incidence. While the evidence suggests a potential protective effect, particularly associated with the pentavalent vaccine, the complexity of T1DM pathogenesis and the need for further research remain salient themes in this ongoing discourse. This literature review will explore these findings in greater detail, critically assessing the methodologies and implications of the studies discussed.

LITERATURE REVIEW

The article titled "Lower Incidence Rate of Type 1 Diabetes after Receipt of the Rotavirus Vaccine in the United States, 2001–2017" by (A. M. Rogers et al., 2019) presents compelling evidence suggesting a significant reduction in the incidence of type 1 diabetes among children who received the complete series of the rotavirus vaccine compared to both a contemporary and historical cohort that was unvaccinated. The findings indicate that the pentavalent rotavirus vaccine, in particular, is associated with a lower risk of developing type 1 diabetes, which aligns with previous research conducted in Australia and observations from the SEARCH for diabetes in youth registry.

The authors effectively contextualize their findings within the existing body of literature that links rotavirus infection to the pathogenesis of type 1 diabetes. They reference animal studies demonstrating that rotavirus can accelerate β -cell destruction in diabetes-prone mice, as well as human studies showing an increase in islet antibody levels with repeated rotavirus infections. This foundational evidence strengthens the argument for a potential protective effect of the rotavirus vaccine against type 1 diabetes.

The study's observational nature is a critical point of consideration. While the authors acknowledge the ethical concerns surrounding a randomized controlled

trial that would withhold the vaccine, the observational design introduces limitations such as potential confounding factors and biases in vaccination status reporting. Notably, the authors mention a significant proportion of infants did not complete the vaccination series, which may reflect broader trends in vaccination uptake influenced by parental attitudes and knowledge. This aspect highlights the need for public health initiatives aimed at improving vaccination coverage to fully realize the potential benefits of the rotavirus vaccine.

Furthermore, the authors discuss the correlation between vaccination rates and the incidence of type 1 diabetes, noting that regions with lower vaccination rates also reported higher diabetes rates. This correlation suggests that improving vaccination coverage could be a pivotal strategy in reducing the incidence of type 1 diabetes, although causation cannot be definitively established from this observational data.

The article also raises an important caveat regarding the possibility that the rotavirus vaccine may not necessarily prevent type 1 diabetes but could instead delay its onset. This distinction is crucial for understanding the long-term implications of vaccination and emphasizes the need for longitudinal studies to explore the lifetime risk of developing type 1 diabetes in vaccinated individuals.

The article by (Zhang et al., 2012) presents a systematic review and meta-analysis that investigates the relationship between rotavirus vaccination and the risk of developing type 1 diabetes as well as celiac disease. This comprehensive evaluation is particularly relevant given the increasing interest in the potential role of vaccines in influencing autoimmune diseases.

The authors meticulously analyzed data from multiple studies to ascertain whether there is a significant association between rotavirus vaccination and the incidence of type 1 diabetes. Their findings suggest that rotavirus vaccination does not appear to increase the risk of developing type 1 diabetes. This is a critical insight, as concerns about the safety of vaccines often arise in discussions about their broader health implications, particularly in relation to autoimmune conditions.

(Zhang et al., 2012) employed rigorous methodologies in their systematic review, ensuring that the studies included were relevant and of high quality. The meta-analysis they conducted synthesizes data effectively, providing a clearer picture of the potential impacts of rotavirus vaccination. The authors highlight that the results align with the hypothesis that vaccination could play a protective role rather than a detrimental one in the context of type 1 diabetes.

Moreover, the article discusses the biological mechanisms that may underlie the relationship between rotavirus infections and autoimmune responses. It is posited that rotavirus may trigger autoimmune processes in genetically predisposed individuals, thus creating a link between viral infections and the onset of diseases like type 1 diabetes. The authors emphasize the need for further research to explore these mechanisms and the long-term effects of vaccination.

The article "Viruses as a potential environmental trigger of type 1 diabetes mellitus (Review)" by (Juliana Paiva Alves Abrantes et al., 2014) provides a comprehensive examination of the relationship between rotavirus infections and the incidence of type 1 diabetes mellitus (T1DM). The authors highlight the initial hypothesis that rotavirus infections could act as environmental triggers for T1DM due to the structural similarities between viral peptide sequences and human pancreatic islet peptide sequences found in individuals with the disease. This aspect of the review sets a foundational understanding of the potential mechanisms linking viral infections to autoimmune responses that may lead to T1DM.

The review critically evaluates various studies that have explored the association between rotavirus infections and T1DM risk, noting the mixed results that have emerged from this body of research. While some studies suggest a possible link, the authors emphasize the complexity of the issue, pointing out that factors such as age and diet may also play significant roles in the development of T1DM. This nuanced perspective is crucial, as it underscores the multifactorial nature of the disease and the necessity for further investigation into the interplay of different environmental triggers.

A significant contribution of the article is its discussion on the impact of rotavirus vaccination on T1DM incidence. The authors reference two recent studies that indicate a potential protective effect of the complete rotavirus vaccination schedule against T1DM. The Australian study and the longitudinal cohort study conducted in the United States, which spans from 2001 to 2017, present compelling evidence that children who received the complete rotavirus vaccine series exhibited a 33% reduced risk of developing T1DM compared to their unvaccinated counterparts. This finding is pivotal, as it suggests that rotavirus vaccination could serve as a preventive strategy against T1DM, a notion that has significant public health implications.

However, the authors also caution against drawing definitive conclusions from these studies due to the need for more extensive research to corroborate these findings. They acknowledge the limitations of current studies, including potential biases and the variability in study designs, which could affect the reliability of the results. This critical evaluation reflects a responsible approach to scientific inquiry, emphasizing the importance of replication and validation in establishing causal relationships.

CONCLUSION

The literature presents a growing body of evidence suggesting a potential protective effect of rotavirus vaccination on the incidence of type 1 diabetes (T1DM). The initial study by (A. M. Rogers et al., 2019) demonstrated a significant reduction in T1DM incidence among vaccinated children, particularly with the pentavalent rotavirus vaccine, while also addressing the complexities of T1DM pathogenesis. This foundational work highlights the necessity of considering various confounding factors and biases inherent in observational studies, as well as the ethical implications of randomized controlled trials in this context.

Following this, the systematic review and meta-analysis conducted by (Zhang et al., 2012) further supported the notion that rotavirus vaccination does not increase the risk of developing T1DM. This comprehensive evaluation synthesized data from multiple studies, reinforcing the hypothesis that vaccination could have

a protective role against the disease. The authors underscored the importance of investigating the biological mechanisms linking rotavirus infections to autoimmune responses, which could elucidate why vaccination may mitigate T1DM risk.

Additionally, the review by (Juliana Paiva Alves Abrantes et al., 2014) explored the environmental triggers of T1DM, including viral infections like rotavirus. It emphasized the mixed results in existing research but pointed to emerging evidence suggesting that complete rotavirus vaccination may indeed lower T1DM incidence. The authors highlighted significant studies showing a notable reduction in T1DM risk among vaccinated children, further supporting the public health implications of vaccination strategies.

In conclusion, the literature reviewed indicates a potential protective effect of rotavirus vaccination against the incidence of T1DM, particularly with the pentavalent vaccine. While the evidence is compelling, the complexities surrounding T1DM pathogenesis and the limitations of observational studies necessitate further research to establish clearer causal relationships. Continued investigation into the mechanisms by which rotavirus vaccination may influence T1DM risk will be essential for validating these findings and informing public health policies.

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