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Breakthroughs in Rare Diseases Therapeutics

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2024 rings positive for those suffering from some kind of rare disease. On January 16, 2024, VertexPharmaceuticals and CRISPR Therapeutics announced that the US Food and Drug Administration has approved the use of Casgevy, a therapy that uses CRISPR gene-editing to treat the serious blood disorder, transfusion-dependent beta-thalassemia, marking the second major US regulatory approval for the emerging gene-editing technology. This approval is a testament to the breakthroughs in therapeutics for rare medical conditions.

The previous year witnessed many promising developments in the fight against rare diseases. The recent Casgevy's FDA approval for beta-thalassemia comes just one month after the US drug regulator approved the use of Casgevy in treating sickle cell disease, which is notably the first time the CRISPR-based treatment received a regulatory green light in the United States.

Casgevy uses the novel CRISPR gene-editing technology to modify patients' blood cells and transplant the modified cells back into the bone marrow, triggering an increase in the production of haemoglobin, according to the FDA.

Rare diseases are considered as a significant health challenge. Between 5,000 and 8,000 rare diseases have been identified and these diseases, though not prevalent like other diseases, as a group, affect 6 to 8 per cent of the global population. Rare diseases present unique problems for not only the individuals living with the rare medical condition but for caregivers, researchers, policymakers, and industries as well.

More than 80 per cent of rare diseases are caused by genetic or congenital aberrations, and 75 per cent present with a wide range of neurological symptoms and physical and intellectual disabilities. Sadly, rare diseases mostly affect children or young adults, and even worse, several siblings can be affected in the same family. As such, these diseases come with substantial hardship for both parents and patients. Hence, advancing therapies to cater to their well-being is of utmost critical.

Urgency for R&D

The APAC region is teeming with exciting new frontiers in rare disease treatment, offering hope for patients previously facing limited options. Ever since the 'Action Plan for Rare Diseases' was launched in 2018 by the APEC Life Sciences Innovation Forum (LSIF) – to improve access to diagnosis, treatment, and care for people with rare diseases – several countries in the

Asia Pacific region have become members. As of October 2023, 21 APEC member economies are participating in the plan that is dominated by APAC-based countries.

Several drugs have either been approved by the respective country's regulatory authorities or have been approved for clinical trial initiation. In 2023, for Acute Graft-versus-Host Disease (GVHD), a cell therapy developed by the Australian company Genetic Technologies received approval in Japan for treating steroid-refractory acute GVHD. This offers a new option for patients facing this life-threatening complication of bone marrow transplants.

Zolgensma, a gene therapy for Spinal Muscular Atrophy (SMA) types 1 and 2, was approved in China in 2023. This groundbreaking therapy offers a single-dose solution for infants and young children with SMA, addressing a critical need in the region.

Funding for this unmet area has also been recorded. The Australian government has announced 27 grant recipients under the 2021 Rare Cancers, Rare Diseases and Unmet Need (RCRDUN) grant opportunity. The grants have been awarded to 27 projects, which aim to increase clinical trial activity in Australia for rare cancers and rare diseases by supporting new, high-quality research.

Significant strides in the rare diseases in the APAC region include:

Precision Medicine: Traditional one-size-fits-all approaches are giving way to targeted therapies based on individual genetic profiles. This personalised approach holds immense potential for rare diseases with diverse genetic causes, allowing for more effective and specific treatments. Early last year, the National Health Research Institutes (NHRI) inked an MoU for precision medicine collaboration with Singapore's KK Women's and Children's Hospital. The two parties will collaborate in three areas: whole-genome sequencing (WGS) clinical services and translational research for rare diseases, with a particular focus on Chinese genetic characteristics.

Gene Editing Tech: Techniques like CRISPR-Cas9 and TALENs offer the potential to permanently correct genetic defects at the source, leading to potential cures for various rare diseases. While still in the early stages, preclinical and clinical trials are ongoing for conditions like Leber's congenital amaurosis, Duchenne muscular dystrophy, and beta-thalassemia. South Korea's Celltrion is developing a gene therapy for Duchenne Muscular Dystrophy (DMD) using CRISPR-Cas9 technology, with plans for clinical trials in 2024. This potentially curative approach targets specific genetic mutations causing DMD.

Gene and Cell Therapy: Stem cell transplants and gene therapy vectors are being explored to introduce healthy genes or repair defective ones. This approach holds promise for diseases like haemophilia, sickle cell disease, and lysosomal storage disorders. For instance, China's GenScript Biotech is developing gene therapies for Hunter syndrome and Leber's congenital amaurosis. GenScript is also developing gene therapies for both types of haemophilia, aiming to provide a permanent cure by introducing functional copies of the missing clotting factor genes. In late 2023, Japan approved Cerezyme, a recombinant enzyme replacement therapy, for Gaucher disease type 1. This approval expands treatment options and access for patients in the region.

AI and Big Data: Advanced computational tools are aiding in drug discovery, patient diagnosis, and clinical trial design. By analysing vast amounts of genetic and clinical data, artificial intelligence (AI) can help identify disease patterns, predict treatment responses, and accelerate the development of new therapies. Researchers at China's Peking University are developing AI models to analyse medical images like CT scans and MRI scans for early detection of rare lung diseases like idiopathic pulmonary fibrosis. Australian researchers, on the other hand, are working on AI-assisted diagnosis of genetic diseases. Researchers at the Garvan Institute of Medical Research are developing AI models to analyse facial features and genomic data for rapid diagnosis of rare genetic syndromes, particularly in newborns.

Building virtual patient cohorts has also been trending for the past few years and is showing a higher trend for future research and deployment. AI is being used to create virtual patient cohorts based on clinical data and electronic health records. This allows researchers to study rare diseases more effectively even with limited patient numbers.

Several startups have also forayed into this space. For example, Ubie Inc., a Japan-based startup, has signed a comprehensive collaboration agreement with Takeda Pharmaceutical Co. to promote digital transformation, which aims to guide people to appropriate medical care for rare diseases.

Regional collaboration

This story throws some light on the progress taking place in APAC's rare disease drug discovery and its market. However,

the landscape of rare disease medicine in the Asia Pacific is much more dynamic and is constantly evolving. Examples cited here are just a glimpse into the promising efforts underway in the regions, offering hope for a brighter future for patients and their families.

But, it's important to note that access to these innovative therapies remains a big challenge in many parts of APAC. Affordability, healthcare infrastructure, and awareness of early detection all play a role in ensuring equitable access for patients across the region.

Though the Orphan Drug Act of many APAC countries incentivises drugmakers to prioritise rare diseases in their pipelines and gives companies marketing exclusivity for additional years before generics enter the market, there is a long road ahead. The APAC region needs to solidify more collaboration between governments, academic institutions, and biopharma companies. Efforts like the APEC Rare Disease Action Plan and the Asia Pacific Rare Disease Network (APRDN) need to increase their knowledge sharing, resource allocation, and clinical trial opportunities.

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