mRNA Vaccine

Why in news?

- India's first indigenous mRNA vaccine candidate, HGCO19, has received approval from Indian Drug regulators to initiate clinical trials.
- Moderna and Pfizer announced results of human trials of Covid-19 mRNA based vaccines showing 94.5 90 percent effectiveness respectively.

What is mRNA?

- Messenger RNA (mRNA) is a single-stranded RNA (Ribo Nucleic Acid) molecule that is complementary to one of the DNA strands of a gene.
- mRNA is an RNA version of the gene that leaves the cell nucleus and moves to the cytoplasm where proteins are made.

What is Vaccine?

- It typically contains an agent that resembles a disease-causing microorganism It may be a weakened or killed forms of the microbe, its toxins, or one of its surface proteins.
- It stimulates our immune system to produce antibodies, exactly like it would if you were exposed to the disease.

Why mRNA Vaccine?

- Conventional vaccine approaches have not been as effective against rapidly evolving pathogens like influenza or emerging disease threats such as the Ebola or Zika viruses.
- RNA based vaccines, are relatively quick to control the spread of infectious diseases, including COVID-19.
- RNA vaccines are faster and cheaper to produce than traditional vaccines
- Production of RNA vaccines is laboratory based, and the process could be standardised and scaled, allowing quick responses to large outbreaks and epidemics

How does mRNA vaccine works?

- The mRNA, is coded to tell the cells to recreate the spike protein of the coronavirus SARS-CoV-2, which causes Covid-19.
- A coronavirus vaccine based on mRNA, once injected into the body, will instruct the body's cells to create copies of the spike protein.
- In turn, this is expected to prompt the immune cells to create antibodies to fight it.
- These antibodies will remain in the blood and fight the real virus if and when it infects the human body.

Benefits

- Safety: RNA vaccines are not made with pathogen particles or inactivated pathogen, so are non-infectious.
- RNA does not integrate itself into the host genome and the RNA strand in the vaccine is degraded once the protein is made.
- Efficacy: early clinical trial results indicate that these vaccines generate a reliable immune response
- They are well-tolerated by healthy individuals, with few side effects.
- Vaccines can be produced more rapidly in the laboratory, which improves responsiveness to emerging outbreaks.

Challenges

- Unintended effects: the mRNA strand in the vaccine may elicit an unintended immune reaction.
- Delivery: delivering the vaccine effectively to cells is challenging since free RNA in the body is quickly broken down.
- Storage: many RNA vaccines, like conventional vaccines, need to be frozen or refrigerated.

Conclusion

- The methods to make mRNA vaccines can be very effective. However, there are technical challenges to overcome to ensure these vaccines work appropriately