VACCINOLOGY II

COVID VACCINES - AN UPDATE

***Vidya Krishna**

Abstract: *From the time COVID-19 infection was first reported from Wuhan, China by the end of December 2019, vaccine production and trials geared up globally and have been successful in bringing out vaccines for use in the community in a year's time. This was made possible as the genome of the SARS-CoV-2 was released by Chinese researchers on 11th January 2020. The scientific advancements and lessons learnt from the previous pandemics due to H1N1(Spanish flu), H2N2(Asian flu), H3N3 (Hong Kong Flu) and SARS outbreak also helped in this regard. This article highlights conventional and newer technologies used in the development of vaccines and the types of vaccines available.*

Keywords: *SARS-CoV-2, Vaccines, Technologies.*

* Specialist Registrar,
Department of Pediatrics,
John Radcliffe Hospital,
Oxford,United Kingdom
email : docvidyakrishna@gmail.com

Points to remember

- ***SARS-CoV-2 is an enveloped, positive sense, single strand RNA virus , that is responsible for the current COVID-19 pandemic.***
- ***Humoral and cellular immune responses in the form of neutralizing antibodies to the receptor binding domain of ACE 2 receptor and Th1 response respectively, have protective effect against the disease and re-infection.***
- ***Several mRNA, viral vector, protein subunit and inactivated vaccines have entered phase 2/3 trials and based on interim safety and efficacy data, obtained emergency use authorization.***
- ***While these vaccines do not have a live virus component and should be safe in the immunocompromised, pregnant and lactating women, we still await safety and efficacy data from trials enrolling these sub-groups.***
- ***COVID-19 causes mild / asymptomatic infections in majority of the children. Currently, no COVID vaccine is approved in children below 16 years of age.***

References

1. Qun Li, Xuhua Guan, Peng Wu, Xiaoye Wang, Lei Zhou, Yeqing Tong, Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. 2020 Mar 26; 382(13):1199-1207. doi:10.1056/NEJMoa 2001316. Epub 2020 Jan 29
2. WHO Coronavirus (COVID-19) dashboard. India Situation. Available from: https://COVID-19.who.int. Last accessed on 6th March 2021.
3. Tregoning JS, Brown ES, Cheeseman HM, Flight KE, Higham SL, Lemm NM, et al. Vaccines for COVID-19. Clin Exp Immunol. 2020 Nov; 202(2):162-192. doi: 10.1111/cei.13517. Epub 2020 Oct 18. PMID: 32935331; PMCID: PMC7597597.
4. Gupta A, Madhavan MV, Sehgal K, Nair N, Mahajan S, Sehrawat TS, et al. Extrapulmonary manifestations of COVID-19. Nat Med. 2020 Jul; 26(7):1017-1032. doi: 10.1038/s41591-020-0968-3. Epub 2020 Jul 10. PMID: 32651579.

5. Mahase E. COVID-19: Past infection provides 83% protection for five months but may not stop transmission, study finds. BMJ. 2021 Jan 14; 372:n124. doi: 10.1136/bmj.n124. PMID: 33446481.
6. Martinon F, Krishnan S, Lenzen G, Magné R, Gomard E, Guillet JG, et al. Induction of virus-specific cytotoxic T lymphocytes in vivo by liposome-entrapped mRNA. Eur J Immunol. 1993 Jul; 23(7):1719-22. doi: 10.1002/eji.1830230749. PMID: 8325342.
7. Geall AJ, Verma A, Otten GR, Shaw CA, Hekele A, Banerjee K, et al. Nonviral delivery of self-amplifying RNA vaccines. ProcNatlAcadSci USA. 2012 Sep 4;109(36): 14604-9. doi: 10.1073/pnas.1209367109. Epub 2012 Aug 20. PMID: 22908294; PMCID: PMC3437863.
8. Schlake T, Thess A, Fotin-Mleczek M, Kallen KJ. Developing mRNA-vaccine technologies. RNA Biol. 2012; 9(11):1319-1330. doi:10.4161/rna.22269
9. Dolgin E. How COVID unlocked the power of RNA vaccines. Nature. 2021 Jan; 589(7841):189-191. doi: 10.1038/d41586-021-00019-w. PMID: 33437061.
10. Zhang C, Maruggi G, Shan H, Li J. Advances in mRNA Vaccines for Infectious Diseases. Front Immunol. 2019 Mar 27; 10:594. doi: 10.3389/fimmu.2019.00594. PMID: 30972078; PMCID: PMC6446947.
11. Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, et al . Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J Med. 2020 Dec 31;383(27):2603-2615. doi: 10.1056/NEJMoa2034577. Epub 2020 Dec 10. PMID: 33301246; PMCID: PMC7745181.
12. Baden LR, El Sahly HM, Essink B, Kotloff K, Frey S, Novak R, et al. Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine. N Engl J Med. 2021 Feb 4; 384(5):403-416. doi: 10.1056/NEJMoa2035389. Epub 2020 Dec 30. PMID: 33378609; PMCID: PMC7787219.
13. Robert-Guroff M. Replicating and non-replicating viral vectors for vaccine development. Curr Opin Biotechnol. 2007 Dec; 18(6):546-56. doi: 10.1016/j.copbio.2007.10.010. Epub 2007 Dec 11. PMID: 18063357; PMCID: PMC2245896.
14. Ramasamy MN, Minassian AM, Ewer KJ, Flaxman AL, Folegatti PM, Owens DR, et al . Safety and immunogenicity of ChAdOx1 nCoV-19 vaccine administered in a prime-boost regimen in young and old adults (COV002): a single-blind, randomised, controlled, phase 2/3 trial. Lancet. 2021 Dec 19; 396(10267):1979-1993. doi: 10.1016/S0140-6736(20)32466-1. Epub 2020 Nov 19. Erratum in: Lancet. 2021 Dec 19; 396(10267):1978. PMID: 33220855; PMCID: PMC7674972.
15. AZD1222 US Phase III trial met primary efficacy endpoint in preventing COVID-19 at interim analysis. Available from: https://www.astrazeneca.com/media-centre/press-releases/2021/astrazeneca-us-vaccine-trial-met-primary-endpoint.html. Accessed on 28/03/2021
16. Sadoff J, Le Gars M, Shukarev G, Heerwegh D, Truyers C, de Groot AM,et al . Interim Results of a Phase 1-2a Trial of Ad26.COV2.S Covid-19 Vaccine. N Engl J Med 2021 Jan 13:NEJMoa2034201. doi: 10.1056/NEJMoa2034201. Epub ahead of print. PMID: 33440088; PMCID: PMC7821985.
17. Oliver SE, Gargano JW, Scobie H, Wallace M, Hadler SC, Leung J, et al. The Advisory Committee on Immunization Practices' Interim Recommendation for Use of Janssen COVID-19 Vaccine - United States, February 2021. MMWR Morb Mortal Wkly Rep 2021;70:329-332. DOI: http://dx.doi.org/10.15585/mmwr.mm7009e.
18. Logunov DY, Dolzhikova IV, Shcheblyakov DV, Tukhvatulin AI, Zubkova OV, Dzharullaeva AS, et al. Gam-COVID-Vac Vaccine Trial Group. Safety and efficacy of an rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine: an interim analysis of a randomised controlled phase 3 trial in Russia. Lancet. 2021 Feb 20; 397(10275):671-681. doi: 10.1016/S0140-6736(21)00234-8. Epub 2021 Feb 2. Erratum in: Lancet. 2021 Feb 20;397(10275):670. PMID: 33545094; PMCID: PMC7852454.
19. Keech C, Albert G, Cho I, Robertson A, Reed P, Neal S, et al . Phase 1-2 Trial of a SARS-CoV-2 Recombinant Spike Protein Nanoparticle Vaccine. N Engl J Med. 2020 Dec 10;383(24):2320-2332. doi: 10.1056/NEJMoa2026920. Epub 2020 Sep 2. PMID: 32877576; PMCID: PMC7494251.
20. NVX-CoV2373 clinical trials. Coronavirus Vaccine Candidate Updates 11 March, 2021. Available from: https://www.novavax.com/covid-19-coronavirus-vaccine-candidate-updates. Accessed on 18th March, 2021.
21. Ella R, Reddy S, Jogdand H, Sarangi V, Ganneru B, Prasad S, et al . Safety and immunogenicity of an inactivated SARS-CoV-2 vaccine, BBV152: interim results from a double-blind, randomised, multicentre, phase 2 trial, and 3-month follow-up of a double-blind, randomised phase 1 trial. Lancet Infect Dis. 2021 Mar 8:S1473-3099(21)00070-0. doi: 10.1016/S1473-3099(21)00070-0. Epub ahead of print. PMID: 33705727.
22. COVID-19 Vaccines .Operational Guidelines. Updated 28th December, 2020. Ministry of Health and Family Welfare. Government of India. Available from: https://www.mohfw. gov.in/pdf COVID-19VaccineOG111 Chapter16.pdf. Accessed on 18th March, 2021.
23. Department of Health. Immunisation against infectious disease. Green Book. COVID-19. Chapter 14a. London: Department of Health 2020; pp1-24.
24. Centre for Disease Control. Interim Clinical Considerations for Use of COVID-19 Vaccines Currently Authorized in the United States. Available from: https://www.cdc.gov/vaccines/covid-19/info-by-product/clinical-considerations.html. Accessed on 18th March, 2021.