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VACCINOLOGY I

SCIENCE AND PRACTICE OF VACCINE SCHEDULING

*** Puneet Kumar**
**** Vipin M Vashishtha**

Abstract: *Vaccination is the most successful and cost-effective health intervention in human history. The success of vaccination programs stands on three pillars namely safe and effective vaccines, high population coverage and optimal scheduling. The scheduling of any vaccine is not straight forward. It is affected by immunological, epidemiological, programmatic factors and the dynamic interactions among these factors in any given population at any given time. This article describes the science and practice behind this scheduling and how this scheduling is different for an individual child as recommended by Indian Academy of Pediatrics and for the community at large, as represented by the National immunization chart (Universal Immunization Program).*

Keywords: *Scheduling vaccines, Immunization chart, Universal immunization program.*

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Points to Remember

- ***Vaccine schedule is planned based on immunological, epidemiological, programmatic factors and the dynamic interactions among these factors.***
- ***National Immunization schedule is mainly focussed on the community, because responsibility of public health is in the best interest of community.***
- ***IAP Immunization schedule is focused on the individual child, because vaccination in health-care is in the best interest of each child.***
- ***Though the objectives are slightly different, the private health-care and public health programs including vaccination schedules should be complementary and not contradictory regarding immunological basics, ethics and epidemiology.***
- ***The scheduling of vaccines is not fixed, but is a dynamic one depending on local epidemiology of the disease, gain in insight/ data and availability of the newer vaccines.***

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VACCINOLOGY I

IMMUNOLOGY OF VACCINES - AN UPDATE

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*** Rajal B Prajapati*

Abstract: *Immunology is a complex subject but understanding the basic functions of the immune system is useful in order to know how the vaccines work, the basis of recommendations for their use, various immunization schedules, combination of vaccines, modifications in reference to epidemiology of the disease, special situations, etc. It is interesting to know how the immune system reacts to live vaccines, inactivated vaccines, polysaccharide and conjugated vaccines. The functioning of antigen presenting cells, dendritic cells, germinal centres and marginal zones in spleen and lymph nodes is very complex. T cell dependent and T cell independent immune responses to different vaccines decide the quality of antibodies and duration of protection. They further decide the number of primary doses and need for boosting. Due to the presence of immune memory, there is no need to restart the entire schedule in case of interrupted vaccinations. The primary and secondary immune responses explain the lag period, types of immunoglobulins produced and duration of protection. The influence of extremes of age, malnutrition, genetic and environmental factors on the immunology of vaccination is a fascinating study.*

Keywords: *Vaccination, Immunology.*

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Points to Remember

- ***Understanding basics of the immune system is useful to learn how vaccines work, basis of recommendation of various immunization schedules, combination of vaccines, modifications in reference to epidemiology of disease and special situations.***
- ***T cell dependent and T cell independent immune responses to various vaccines decide the quality of antibodies and duration of protection.***
- ***Because of immune memory there is no need to restart the entire vaccine schedule in case of an interruption. This phenomenon also decides the need for booster doses.***
- ***The primary and secondary immune responses explain lag period, types of immunoglobulins and duration of protection.***
- ***Extremes of age, malnutrition, genetic and environmental factors also play a role in immunological response to vaccines.***

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VACCINOLOGY I

DIPHTHERIA, PERTUSSIS, TETANUS VACCINES

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*** Harish K Pemde*

Abstract: *DPT vaccine is one of the oldest vaccines mankind was gifted with. Over time newer vaccines like DTaP were introduced with lesser side effects but shorter lasting immunity. Both IAP and Govt of India endorse DTwP vaccine because of its greater efficacy. In 2018, TT vaccine was replaced with Td for vaccination at 10, 16 years in UIP schedule in India. Adolescent and adult vaccination now include one single dose of Tdap. Pregnant women are also now recommended to have a single dose of Tdap followed by Td as a routine immunization. Pertagen is a newly developed monovalent acellular pertussis vaccine containing genetically inactivated Pertussis Toxin. Boostagen (TdaPBioNet) is produced with genetically inactivated recombinant B. pertussis component. Both these vaccines are licensed in Thailand and further studies on these vaccines are going on in many developed countries. There are few newer combination hexavalent vaccines containing DPT, Hib, Hep-B and IPV which are also equally efficacious and have the potential to replace the routine vaccines in near future.*

Keywords: *DPT vaccine, Immunization, Newer pertussis vaccines.*

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Points to Remember

- ***DPT is an essential part of the immunization program in most countries and can be given alone or as a combination vaccine.***
- ***Paracetamol given as treatment or prophylaxis for fever does not impair the immunological response to DPT containing vaccines.***
- ***For unimmunized children aged of 1-7 years, the recommended catch up primary schedule is 3 doses with a minimum interval of 4 weeks between the first and the second dose and 6 months between the second and third doses.***
- ***A single dose of Tdap should be used as booster in adolescents and adults if they have not received Tdap earlier; during pregnancy one dose of Tdap should be administered at the first contact and second Td should be given at least 2 weeks before the delivery.***
- ***Absolute contraindications to all DPT containing vaccines are history of anaphylaxis or encephalopathy not attributable to any underlying cause and onset within 7 days of vaccination; progressive neurological disease is a relative contraindication for first dose of DTwP.***

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VACCINOLOGY I

POLIO VACCINES

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Abstract: *Global Polio Eradication and Endgame Strategic Plan 2013-18 has emphasized complete and ultimate withdrawal of oral polio vaccines from all immunization programs across the globe. The term 'eradication' addresses wild polio virus and 'endgame' addresses vaccine associated paralytic polio and Vaccine Derived Polio Virus. The most crucial step in this direction was global implementation of synchronized withdrawal of type 2 Oral Polio Vaccine in 2016 through a switch from trivalent Oral Polio Vaccine to bivalent Oral Polio Vaccine. Still this can be associated with small but real risk of Vaccine Derived Polio Virus outbreaks. To address this vital issue, all Oral Polio Vaccine doses should ideally be replaced by inactivated poliovirus vaccine. Inactivated poliovirus vaccine introduction (in previously Oral Polio Vaccine only using countries) has increased global inactivated poliovirus vaccine demand, resulting in demand greater than supply. Such shortage has resulted in giving fractional doses of inactivated poliovirus vaccine intradermally as a risk mitigation in our national immunization program. Currently, Advisory Committee on Vaccines and Immunization Practice recommends bivalent oral polio vaccine at birth followed by inactivated poliovirus vaccine at 6 - 10 - 14 weeks stand alone or as part of Diphtheria Tetanus and whole cell pertussis vaccine / Diphtheria Tetanus and acellular pertussis vaccine combos and a booster of inactivated poliovirus vaccine / combo at 15-18 months and second booster at 4 to 6 years of age. An alternate schedule is two doses of intramuscular inactivated poliovirus vaccine instead of three for primary series if started at 8 weeks, with an interval of 8 weeks between two doses. All inactivated poliovirus vaccine immunized children should receive Oral Polio Vaccine on all supplementary immunisation activity days till 5 years of age. In case injectable inactivated poliovirus vaccine is not available or feasible child should be given 3 doses of bivalent oral polio vaccine with two fractional doses of Inactivated poliovirus vaccine (IPV) at a Government facility at 6 and 14 weeks or at least one dose of intramuscular inactivated poliovirus vaccine, either standalone or as a combination vaccine, at 14 weeks of age.*

Keywords: *Polio vaccines, VAPP, cVDPV, Polio eradication.*

Points to Remember

- ***Poliomyelitis, a serious crippling disease is now on the verge of eradication. Role of both inactivated polio vaccine (IPV) and oral polio vaccine (OPV) is indispensable. Among these, OPV is the major contributor to India's success story in polio elimination and eradication.***
- ***OPV is extremely safe and effective, cheap and easy to administer. It imparts excellent gut immunity. In some unforeseen situations it rarely causes Vaccine-associated paralytic polio (VAPP) and Vaccine-derived polioviruses (VDPVs).***
- ***Global Polio Eradication and Endgame Strategic Plan 2013-18 has emphasized complete and ultimate withdrawal of oral polio vaccines (OPV) from all immunization programs across the globe.***
- ***All OPV doses should ideally be replaced by IPV. If not feasible child should continue 3 doses of bOPV with 2 doses of fIPV at public sector.***
- ***An IPV-only schedule may be considered in countries with both sustained high immunization coverage and the lowest risk of both WPV importation and transmission. A primary series of 3 doses of IPV should be administered beginning at 2 months of age. If the primary series begins earlier (e.g. with a 6, 10 and 14-week schedule) then a booster dose should be given after an interval of ≥6 months (for a 4-dose schedule).***
- ***To mitigate the risk of undetected transmission, WHO recommends that endemic countries and countries with a high risk of WPV importation should not***

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switch to an IPV-only or a sequential or 2 doses of fIPV - bOPV schedule at this time. The 3 bOPV+ 1 IPV or two doses of fIPV schedule as currently recommended should be adopted and supplemental immunization activities should continue to support intensive efforts to eliminate poliovirus transmission.

- ***Combined IPV+OPV schedules appear to correct for the lower immunogenicity of OPV in developing countries. IPV induces pharyngeal immunity similar to that of OPV, but much less intestinal immunity.***
- ***Birth dose OPV and OPV in SIAs till 5 years of age are very important.***

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VACCINOLOGY I

ROTAVIRUS VACCINATION

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Abstract: *Acute gastroenteritis is one of the leading causes of death in under 5 age group globally. Rotavirus is the most common pathogen causing acute gastroenteritis in children. Rotavirus vaccination has reduced the mortality rate both in low and high income countries. Various high efficacy vaccines are now available. Two indigenously manufactured Indian vaccines are now used in National Immunization Schedule of India. All the currently available vaccines are given orally and safe to use.*

Keywords: *Gastroenteritis, Rotavirus, Rotavirus vaccine.*

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Points to Remember

- ***Rotavirus vaccines have high efficacy in preventing severe RVGE and rotavirus gastroenteritis associated hospitalizations.***
- ***The current generation of rotavirus vaccines are quite safe.***
- ***It is important to give the first dose at 6 weeks to ensure optimum protection against severe rotavirus gastroenteritis (RVGE) in the vulnerable early infancy period.***
- ***Indigenously manufactured two low cost effective vaccines are available under Universal Immunisation Programme in India.***
- ***Intussusception following rotavirus vaccines is rare. Prospective surveillance has not revealed any increased risk for intussusception in the post-vaccine period, but the surveillance continues.***
- ***It is important to monitor for antigenic/genetic modifications in novel circulating rotavirus strains for which the available rotavirus vaccines may not be effective and for this continued surveillance is necessary.***

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VACCINOLOGY I

CENTRAL NERVOUS SYSTEM VACCINES

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Abstract: *Vaccines preventing acute central nervous system infections are absolutely essential, because of the high mortality and morbidity associated with these infections. In many viral and bacterial infections, such as pneumococcus, Hemophilus influenzae, mumps, measles and varicella, central nervous system is involved. In this article three important vaccines such as Meningococcal vaccine, Japanese Encephalitis vaccine and Rabies vaccine are covered. Among these, rabies vaccine is also used both as pre and post exposure vaccine.*

Keywords: *Meningococcal vaccine, Japanese encephalitis vaccine, Antirabies vaccine.*

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Points to Remember

- ***Many bacterial or viral infections can lead to CNS infections or complications related to CNS.***
- ***JE disease carries a high risk of mortality of around 30% and 30% to 40% of survivors suffer from long term neurological sequelae and morbidity, hence JE vaccination is essential for children and adolescents living in endemic areas.***
- ***Because of the intense vaccination, strategies currently the incidence JE has been drastically reduced in the endemic states of India.***
- ***Meningococcal vaccine has not been placed in the list of routine immunization. But is being used for specific purposes like travelling abroad.***
- ***Antirabies vaccine has been used both as pre and post exposure vaccine. Site of vaccination is important and it is given in deltoid region as well as in the lateral aspect of thgh. It should never be given in the gluteal region.***
- ***In class III exposure, rabies immunoglobulin or monoclonal antibody has to be given in addition to antirabies vaccine.***
- ***Antirabies vaccine as ID injections required to be given only by trained personnel, in the deltoid, anterolateral thigh or suprascapular regions***

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VACCINOLOGY I

COLD CHAIN - MAINTENANCE AND MONITORING

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Abstract: *The cold chain, also known as the immunization supply chain, is the lifeline of any immunization program. It is a system of storing and transporting vaccine at the recommended temperature range from the point of manufacture to point of use. The main components are personnel, equipment and protocols. The cold chain equipment in use are the domestic refrigerators, ice-lined refrigerators and the purpose-built refrigerators. Temperature monitoring devices include the vaccine vial monitors, thermometers, data loggers and freeze indicators. Passive storage devices include vaccine carriers and cold boxes. Vaccines should be stored in a recommended manner for optimal storage and maintenance of the recommended temperature range. New technologies and innovations are being harnessed to improve the performance of the cold chain system.*

Keywords: *Vaccine, Cold chain.*

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Points to Remember

- ***Cold chain is a system of storing and transporting vaccine at the recommended temperature range from the point of manufacture to point of use.***
- ***The main components of the cold chain are personnel, equipment and protocols.***
- ***The cold chain equipment used for storing and transporting vaccines may be active or passive systems. Active system refrigerators operate on electricity obtained from a power grid and off-grid using either LPG, kerosene or solar power. Passive systems consist of cold boxes and vaccine carriers, involving no active refrigeration mechanism.***
- ***Vaccine storage in the refrigerators should be based on thermolability of the vaccines and adequate knowledge of temperature zones within the device.***
- ***Temperature monitoring devices include the vaccine vial monitors, thermometers, data loggers and freeze indicators.***
- ***A 'cold chain breach' is said to have occurred if vaccine storage temperatures are beyond the recommended range of +2°C to +8°C and an action plan should be made for such eventualities.***

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VACCINOLOGY I

OVERVIEW OF VPD SURVEILLANCE IN INDIA

** Bhaskar Shenoy*

Abstract: *Disease surveillance is an important component of public health programs. Vaccine preventable disease surveillance consists of collection of data on vaccine preventable diseases that is utilized for focused interventions for control, elimination or eradication of the disease under surveillance. The key objectives of efficient surveillance system are to assess the burden of a disease in the community, monitor the progress of interventions for disease reduction, assess the impact on disease epidemiology and early detection of outbreaks to implement appropriate control measures. In India, the main vaccine preventable diseases under surveillance are polio, measles, rubella, diphtheria, pertussis and neonatal tetanus. All health facilities including government, NGOs, private clinics, hospitals and laboratories should notify all cases under surveillance including tuberculosis to local health authorities every month. Government of India implements all these programs in coordination with World Health Organization and other partners in immunization.*

Keywords: *Vaccine preventable diseases, Surveillance, Children.*

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Points to Remember

- ***VPD surveillance is an important platform for collection of data on incidence and prevalence of vaccine preventable diseases.***
- ***This data is utilized for focused actions and interventions leading to control /eradication of infectious diseases.***
- ***It measures impact and quality of immunization programs and generates evidences for new vaccine introduction.***
- ***Multiple surveillance systems are operational in India.***
- ***All health care workers should regularly report VPDs and contribute to eradication of infectious diseases.***

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DRUG PROFILE

ORAL IRON PREPARATIONS FOR NEONATES AND CHILDREN

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Abstract: *Iron deficiency anemia (IDA) is one of the most common public health concerns globally, more so in developing countries like India. Iron deficiency in pregnancy, infancy and early childhood results in health and neurodevelopmental problems in the first 1000 days of life. Oral iron supplementation is preferred for prevention and treatment of iron deficiency anemia. This article is a review of the various oral iron preparations available in the market.*

Keywords: *Iron deficiency, Anemia, Children, Ferrous, Ferric.*

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Points to Remember

- ***Iron deficiency anemia is extremely common in children and is of great public health importance.***
- ***Prevention, early identification and treatment of iron deficiency is essential for normal neurodevelopment.***
- ***Ferrous formulations are preferred for oral iron supplementation.***
- ***Prudent selection of appropriate formulation and awareness of elemental iron provided in each, help to ensure correct dosing.***

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DERMATOLOGY

TOPICAL CORTICOSTEROIDS IN CHILDREN - AN OVERVIEW

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Abstract: *Topical corticosteroids are extensively used in steroid responsive pediatric dermatoses by virtue of anti-inflammatory, antiproliferative and immunosuppressive effects. They are classified into various groups depending on the potency of the molecule. In pediatric age group least potent to mid potent topical corticosteroids are used depending on the age and site. The quantity, duration of application, vehicle and concentration of the molecule determine the outcome of the disease and prevention or reduction of the adverse effects. Vehicles in different forms are used for different anatomical sites. In chronic conditions, when steroids are to be used for longer period of time one has to judiciously taper the potency of the corticosteroid molecule, reduce the frequency of application or change to non-steroidal formulation in order to reduce the adverse effects. There is a need to address the issue of corticosteroid phobia which is quite often observed among physicians and parents.*

Keywords: *Corticosteroids, Potency, Vehicle, Steroid phobia.*

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Points to Remember

- ***Mild and least potent topical corticosteroids are to be used for infants and mid to moderate potent steroids in children.***
- ***Least potent steroids are safe for use in the flexural areas***
- ***Desonide or hydrocortisone cream can be used over the face.***
- ***Mometasone cream is to be used above two years of age.***
- ***Creams to be used over the body and face and ointment over the thick regions like palms and soles***
- ***Duration of application is usually for 2 weeks - 4 weeks in case of least potent steroids. Then taper the potency or change to intermittent application as per clinical scenario.***
- ***Parents and adolescent patients have to be counselled about compliance to treatment, adverse effects and steroid phobia.***

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GENERAL ARTICLE

APPLICATION OF FLOW CYTOMETRY IN PEDIATRIC HEMATOLOGY / ONCOLOGY

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Abstract: *Flow cytometry (FC) is a laser-based technology which is used to detect and measure physical and chemical characteristics of a population of cells or particles. It is a tool for rapid analysis, where thousands of cells can be quickly examined and processed by a computer. It is highly useful in the study of immune dysfunction and hematological malignancies. In the last 60 years, millions of HIV infected patients in resource poor environments are living longer through therapy management guided by flow cytometry. It is also useful in the diagnosis of many rare but benign illness like paroxysmal nocturnal hemoglobinuria. Great benefit of flow cytometry is the ability to test large number of cells in a short time. It has lot of applications in diagnostics and recently flow cytometry assays have been developed to identify parasites such as cryptosporidium and giardia. This article covers the principles of flow cytometry - Optics, Fluidics ad Dynamics, its diagnostic applications and limitations in present use.*

Keywords: *Hematological malignancy, Minimal residual disease, Immune deficiency.*

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Points to Remember

- ***Flow cytometry analyses various qualitative and quantitative characteristics of a cell, such as cell size and cellular contents.***
- ***Though the mechanism is complex, it has wide application in the diagnosis of various hematological conditions ranging from benign disorders like fetal maternal hemorrhage to malignancy and immune deficiency.***
- ***Identification odf minimal residual diseases plays a major role in the management of children with leukemia.***
- ***Flow cytometry also helps in identifying prognostic markers and markers for therapeutic use, such as use of rituximab in tumor cells expressing CD 20.***

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ADOLESCENCE

MANAGEMENT OF ADOLESCENT SUICIDAL BEHAVIOUR

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Abstract: *Suicide is one of the leading causes of adolescent mortality globally and in India. Genetic susceptibility, underlying psychiatric illness and negative life events make vulnerable adolescents take this drastic step. Questions about suicidal ideation should be asked during routine HEEADSSS assessment in non-judgmental manner and those with suicidal ideation should be asked about the intent and plan and need detailed evaluation for risk stratification. In addition to screening and detailed evaluation, initial counselling should be done by the pediatrician and consultation with a mental health specialist must be arranged on an emergency basis.*

Keywords: *Suicide, Adolescents, Risk stratification, Safety planning, Prevention.*

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Points to Remember

- ***Adolescence is the period with high vulnerability to various high risk behaviours. Suicide is one of the top causes of adolescent mortality in India and is the result of interplay of genetic and multiple environmental factors.***
- ***Adolescents do not reveal suicidal thoughts unless asked and hence screening for psychosocial issues should be performed in all of them beyond the presenting complaints.***
- ***Assessment of suicidal behavior includes current suicidal ideation, intent, plan, past attempts and assessment of risk as well as protective factors.***
- ***Many of the adolescents exhibit one or more of the warning signs which need to be recognized by the caretakers. Any suicidal threat should be taken seriously.***
- ***Screening tools should only supplement and not replace thorough clinical evaluation***
- ***Management depends on the risk stratification and referral to mental health specialist is a must in all those with suicidal ideation.***
- ***Safety planning intervention should be given to the at-risk adolescent who should be educated to use the same during crisis.***
- ***Many suicidal attempts are preventable with adequate training of 'the gate keepers'.***

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CASE REPORT

A RARE COMPLICATION OF DISTAL RENAL TUBULAR ACIDOSIS

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Abstract: *We report a 9 year old girl with distal renal tubular acidosis presenting with acute hypokalemia following withdrawal of potassium citrate supplementation. During the course of severe hypokalemia, she developed acute rhabdomyolysis and hyperkalemia, a rare complication. To the best of our knowledge, this is the first report of hypokalemic rhabdomyolysis in a child with distal renal tubular acidosis from India.*

Keywords: *Distal renal tubular acidosis, Hypokalemia, Rhabdomyolysis, Creatine kinase.*

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