ADULT IMMUNIZATION

Editors
S.K. Sharma  R.K. Singal  A.K. Agarwal
New Delhi  New Delhi  New Delhi

Associate Editors
Alladi Mohan  Gautam Ahluwalia
Tirupati  Ludhiana

Principal Editorial Advisors
Y.P. Munjal  S.K. Bichile
New Delhi  Mumbai

Members – Editorial Board
Sujit Kumar Bhattacharya  Shashank R. Joshi
Indian Council of Medical Research  Mumbai

Vinay Gulati  O.P. Kalra
New Delhi  Delhi

Pritam Gupta  Sandhya Kamath
New Delhi  Mumbai

D.G. Jain  Jai P. Narain
New Delhi  World Health Organization

Sanjay Jain  S.C. Sharma
Chandigarh  New Delhi
ADULT IMMUNIZATION

Editors

S.K. Sharma
Chief, Division of Pulmonary, Critical Care and Sleep Medicine
Professor and Head, Department of Medicine
All India Institute of Medical Sciences
Ansari Nagar, New Delhi - 110 029

R.K. Singal
Past-President
The Association of Physicians of India
Senior Consultant, Internal Medicine
BLK Memorial Hospital
New Delhi - 110 005

A.K. Agarwal
President
The Association of Physicians of India
Chief Consultant, Professor and Head
Department of Medicine
Postgraduate Institute of Medical Education and Research
Dr. Ram Manohar Lohia Hospital
New Delhi - 110 001

Associate Editors

Alladi Mohan
Chief, Division of Pulmonary, Critical Care and Sleep Medicine
Professor and Head, Department of Medicine
Sri Venkateswara Institute of Medical Sciences
Tirupati - 517 507 (Andhra Pradesh)

Gautam Ahluwalia
Professor, Department of Medicine
Medical Officer Incharge, Emergency Services
Dayanand Medical College and Hospital
Ludhiana - 141 001 (Punjab)
Contributors

S.K. Acharya
Professor and Head
Department of Gastroenterology
All India Institute of Medical Sciences (AIIMS)
Ansari Nagar, New Delhi - 110 029

Gautam Ahluwalia
Professor
Department of Medicine
Dayanand Medical College and Hospital
Ludhiana - 141 001

Nita Bhandari
Joint Director
Society of Applied Studies
45, Kalu Sarai, New Delhi - 110 016

Kaushik Bharati
Scientific Consultant
National Institute of Immunology
Aruna Asaf Ali Marg, New Delhi - 110 067

Neerja Bhatla
Additional Professor
Department of Obstetrics and Gynaecology
All India Institute of Medical Sciences (AIIMS)
Ansari Nagar, New Delhi - 110 029

S.K. Bhattacharya
Additional Director General
Indian Council of Medical Research
Ansari Nagar, New Delhi - 110 029

Rakesh Bhatnagar
Professor
Room No. 102, School of Biotechnology
Jawaharlal Nehru University
New Delhi - 110 067

Swati Y. Bhave
Senior Consultant
Indraprastha Apollo Hospital and Max Health Care
New Delhi

Jaya Chakravarty
Department of Medicine
Institute of Medical Sciences
Banaras Hindu University, Varanasi - 221 005

U.C. Chaturvedi
Former Professor and Head
Department of Microbiology
King George Medical College
Lucknow - 226 003

Virander Singh Chauhan
Director
International Centre for Genetic Engineering and Biotechnology
P.O. Box No. 10504
Aruna Asaf Ali Marg
New Delhi - 110 067

Anil Chawla
Vice-President
Panacea Biotec Limited
New Delhi - 110 044

Kamlesh Gidwani
Institute of Medical Sciences
Banaras Hindu University
Varanasi - 221 005

Vinay Gulati
Assistant Professor
Department of Medicine
All India Institute of Medical Sciences (AIIMS)
Ansari Nagar, New Delhi - 110 029

Pranav Gupta
Department of Pathology
All India Institute of Medical Sciences
Ansari Nagar, New Delhi - 110 029

Umesh Datta Gupta
Scientist E
Experimental Animal Facility
National JALMA Institute for Leprosy and Other Mycobacterial Diseases (ICMR)
Miyazaki Marg, Taj Ganj
Agra - 282 001

Sunil Gupta
Joint Director
Division of Microbiology
National Institute of Communicable Diseases
22, Sham Nath Marg, Delhi - 110 054
Contributors / viii

R.L. Ichhpujani
Additional Director
National Institute of Communicable Diseases
22, Sham Nath Marg, Delhi - 110 054

Sanjay Jain
Professor
Department of Internal Medicine
Postgraduate Institute of Medical Education and Research
Chandigarh - 160 012

Premashish Kar
Director-Professor
Department of Medicine
Maulana Azad Medical College and Lok Nayak Hospital
University of Delhi
New Delhi - 110 002

T. Kadhiravan
Assistant Professor
Department of Medicine
Jawaharlal Institute of Postgraduate Medical Education and Research
Dhanvantri Nagar, Puducherry - 605 006

V.M. Katoch
Director General, Indian Council of Medical Research
Secretary, Department of Health Research
V. Ramalingaswami Bhawan
Ansari Nagar, New Delhi - 110 029

Shashi Khare
Consultant and Head
Division of Microbiology
National Institute of Communicable Diseases
22, Sham Nath Marg, Delhi - 110 054

Prasad S. Kulkarni
Sera Institute of India Ltd.
212/2, Hadapsar
Pune - 411 028

Manoj Kumar
Assistant Professor
Department of Hepatology
Institute of Liver and Biliary Sciences
D-1, Vasant Kunj
New Delhi - 110 070

Samir Lakhashe
National AIDS Research Institute
Plot No.73, ‘G’-Block, MIDC
Bhosari, Pune - 411 026

Shiv Lal
Special Director General of Health Services and
Director, National Institute of Communicable Diseases
22, Sham Nath Marg, Delhi - 110 054

Dipendra K. Mitra
Associate Professor
Department of Transplant Immunology and Immunogenetics
All India Institute of Medical Sciences (AIIMS)
Ansari Nagar, New Delhi - 110 029

Veena Mittal
Joint Director and Head
Zoonosis Division
National Institute of Communicable Diseases
22, Sham Nath Marg, Delhi - 110 054

S.K. Panda
Professor and Head
Department of Pathology
All India Institute of Medical Sciences (AIIMS)
Ansari Nagar, New Delhi - 110 029

Ramesh Paranjape
Director
National AIDS Research Institute
Plot No.73, ‘G’-Block, MIDC
Bhosari, Pune - 411 026

Madhukar Rai
Professor
Department of Medicine
Institute of Medical Sciences
Banaras Hindu University, Varanasi - 221 005

Reeta Rasaily
Assistant Director General
Division of Reproductive Health and Nutrition
Indian Council of Medical Research
Ansari Nagar, New Delhi - 110029

Shiv K. Sarin
Director Professor and Head
Department of Gastroenterology
Room No. 201, Academic Block
G.B. Pant Hospital, New Delhi - 110 002

Nitin Shah
Consultant Paediatrician
P.D. Hinduja National Hospital and Medical Research Centre
Veer Savarkar Marg, Mahim, Mumbai - 400 016
Foreword

The scientists all over the world in their conquest against infective disorders, discovered immunization as a useful way to prevent some of these disorders before even the Koch’s Principle was enunciated and the first anti-infective agent sulphonamide discovered.

A little over 300 years ago, Edward Jenner, a country doctor in England, started the concept of immunization which was to become one of the major and landmark discoveries in the field of Medicine. Not to take away even an iota of credit from the discovery of Edward Jenner, it would be pertinent to mention that the process of “variolation” was being practised much earlier in China, India, and Persia. The scientific growth in the process of immunization has advanced very significantly and vaccines and sera are available for prevention of various infective disorders including some of the viral disorders for which no definitive treatment is available till date. From the time in the year 1903 smallpox vaccine was licensed for use for general public, nearly 45 other vaccines and toxoids, apart from several immunoglobulin preparations, were introduced to fight some of the most dreaded medical conditions.

The importance of paediatric immunization is well-established and the immunization schedule has been well-documented as well as propagated. However, adult immunization has failed to elicit the required enthusiasm as well as practice by the practitioners of the modern system of medicine. In a country like USA, it is observed that only two percent of the adult population is immunized against various infective disorders against which we have effective vaccines, sera and toxoids available.

Dr. R.K. Singal, before relinquishing as the President of API, suggested and emphasized the importance of focusing the attention of Indian physicians to the importance of Adult Immunization. He was thus requested and entrusted the responsibility of editing and bringing out a monograph on the benefits of adult immunization and to focus on some of the newer vaccines which are in the pipeline. These newer vaccines when available shall also be able to prevent morbidity and mortality against very serious diseases like malaria and human immunodeficiency virus (HIV), not only benefiting the people in the subcontinent but globally. In this endeavour, he was associated with two stalwarts, Prof. S.K. Sharma and Prof. A.K. Agarwal who have very meticulously planned the contents of this monograph. The authors who were invited to contribute have immense practical experience and enough academic expertise to give a balanced view about the benefits of immunization in adults to physicians at large.

On going through this book, one is singularly impressed by the information provided in an encapsulated manner and the utility of various vaccines has been very well dealt with. However, it also focuses on vaccines which are under the process of investigation and may become available for human use in day-to-day clinical practice – especially malaria and HIV.

Before I conclude, I would once again compliment the Editors of this useful monograph because it is a timely and will act as a ready reckoner for students, teachers and practising physicians.

Dr. Y.P. Munjal
Editor-in-Chief
API Textbook of Medicine
Preface

Immunization of adults against several diseases that are still a major public health problem in the developing countries, such as India, is a controversial issue. Reliable epidemiological data regarding the burden of diseases in general, and infectious diseases in particular, from India are lacking. Sparse published data are available regarding the efficacy and safety of various adult immunization strategies. Furthermore, there is paucity of data regarding objective monitoring of the adequacy of immunization (e.g. optimal antibody titre) against various infectious diseases.

Keeping these issues in mind, the present monograph has been conceived to give a balanced overview regarding the current state-of-the-art evidence on various aspects related to adult immunization and to provide a basis for rational scientific practice. It is hoped that practising clinicians and postgraduate students will find this monograph a valuable reference manual.

S.K. Sharma
R.K. Singal
A.K. Agarwal
## Contents

1. **Anthrax Vaccine** ......................................................... 1  
   Anil Chawla, Rakesh Bhatnagar

2. **Cholera Vaccines** .......................................................... 8  
   S.K.Bhattacharya, Reeta Rasaily

3. **Dengue Virus Vaccines** .................................................. 11  
   U.C. Chaturvedi

4. **Diphtheria, Tetanus and Acellular Pertussis Vaccines: Status in Adults** .................. 23  
   Subhash Varma, Molly M. Thabah

5. **Haemophilus influenzae Type b Vaccine** ................................... 39  
   Nitin Shah

6. **Hepatitis A Vaccine** .......................................................... 48  
   Premashish Kar, Rajiv Singla

7. **Hepatitis B Vaccination** ..................................................... 56  
   Manoj Kumar, Shiv K. Sarin

8. **Hepatitis E Virus Vaccine** .................................................. 66  
   Pranav Gupta, S.K.Acharya and S.K. Panda

9. **Human Immunodeficiency Virus Vaccine** .................................... 77  
   Ramesh Paranjape, Meera Singh and Samir Lakhashe

10. **Human Papillomavirus (HPV) Vaccine** ........................................ 85  
    Neerja Bhatla

11. **Influenza Vaccine** ............................................................ 95  
    Vinay Gulati, Jaya Prakash Sugunaraj

12. **Japanese Encephalitis** .................................................... 104  
    Kaushik Bharati, Sudhanshu Vrati

13. **Leishmania Vaccine** .......................................................... 111  
    Kamlesh Gidwani, Madhukar Rai, Jaya Chakravarty, Shyam Sundar

14. **Leprosy Vaccines** ............................................................. 116  
    Vishwa Mohan Katoch, Umesh Datta Gupta

15. **Immunization in Humans with Experimental Malaria Vaccines** .................. 121  
    Virander Singh Chauhan

16. **MMR Vaccine** ............................................................... 130  
    Sanjay Jain, Vikas Suri
17. Meningococcal Vaccination ................................................................. 136
   Sunil Gupta, Smrita Singh, Shashi Khare, Shiv Lal

18. Pneumococcal Vaccine ................................................................. 146
   S.K. Sharma, T. Kadhivaran

19. Rabies Immunization ................................................................. 151
   R.L. Ichhpujani, Veena Mittal, Shiv Lal, Prasad S. Kulkarni

20. Rotavirus Vaccines ................................................................. 163
   Pooja Sharma, Nita Bhandari

21. Typhoid Vaccines ................................................................. 171
   Reeta Rasaily, S.K. Bhattacharya

22. Yellow Fever Vaccine ................................................................. 177
   Gautam Ahluwalia, S.K. Sharma

23. Tuberculosis Vaccine: Immunology, Strategies and Status ................. 182
   Dipendra K. Mitra, Prabhat K. Sharma

24. Varicella and Herpes Zoster Vaccines ........................................... 192
   Swati Y. Bhave

Index .................................................................................................. 203