Management of anaphylaxis:

(a) Hospital setting

Anaphylaxis:

Anaphylaxis can vary in severity and rapidity of onset. With **mild anaphylaxis** the changes may be confined to the skin or peripheral oedema may occur.

The signs of **major anaphylaxis** may include -

-Flushing, urticaria, itching, stridor, wheeze, dyspnoea.
-Oedema of face, tongue, larynx.
-Hypotension, tachycardia (may help distinguish from vaso-vagal syncope).

The symptoms of anaphylaxis are maximal in 5-30 mins.

May lose 30% blood volume by capillary leak.

Rarely occurs after vaccination.

Treatment:

- Inadequacy of the airway, breathing and circulation must be treated first.
- Adrenaline, fluids and oxygen are the mainstays of treatment.
- Adrenaline is given IM, or IV if shock or severe dyspnoea are present. If IV access is not possible, consider intralingual or intraosseous administration.
- Fluid (20 mls/kg) must be given rapidly to restore impaired peripheral perfusion. Repeated boluses (up to a total of 200 mls/kg) may be necessary.
- Corticosteroids and antihistamines have no effect on the acute manifestation, but may reduce or prevent delayed manifestations.
- All cases of anaphylaxis should be admitted to hospital for at least 24 hours, because late deterioration may occur.

(b) Community setting

Glossary

AIDS:	Acquired Immunodeficiency Syndrome
Anti-HBc:	Antibody to Hepatitis B Core Antigen
Anti-HBs:	Antibody to Hepatitis B Surface Antigen
Anti-HCV:	Hepatitis C antibody
BCG:	Bacille Calmette Guerin Vaccine
DT:	Adsorbed Diphtheria toxoid and Tetanus toxoid
DTaP:	Adsorbed Diphtheria, Tetanus and acellular Pertussis
HAV:	Hepatitis A Virus
HBV:	Hepatitis B Virus
HBIG:	Specific Hepatitis B Immunoglobulin/hyperimmune globulin
HBeAg:	Hepatitis B e antigen
HBsAg:	Hepatitis B surface antigen
HCW:	Healthcare Worker
HDCV:	Human Diploid Cell Rabies Vaccine
Hib:	*Haemophilus influenzae* Type b
HIV:	Human Immunodeficiency Virus
HNIG:	Human Normal Immunoglobulin
HRIG:	Human Rabies Immunoglobulin
IBTS:	Irish Blood Transfusion Service
IPV:	Inactivated Polio Vaccine
I.U.:	International units
MDR-TB:	Multi-Drug Resistant TB
Men C:	Meningococcal C
MMR:	Measles, Mumps and Rubella
OPV:	Oral Polio Vaccine
PPD:	Purified Protein Derivative
ROI:	Republic of Ireland
SC:	Subcutaneous
SSPE:	Subacute Sclerosing Panencephalitis
Td:	Adsorbed tetanus toxoid plus adult diphtheria toxoid
TIG:	Tetanus immune globulin
TST:	Tuberculin Skin Test
Tu:	Tuberculin
VZ:	Varicella Zoster
VZIG:	Varicella Zoster Immunoglobulin
VZV:	Varicella Zoster Virus
WHO:	World Health Organisation

NATIONAL IMMUNISATION ADVISORY COMMITTEE

List of Members

Chairman:

Prof. J.A.B. Keogh
Past President, Royal College of Physicians of Ireland

Committee Members:

Dr. Karina Butler
Consultant in Paediatric Infectious Diseases,
Our Lady's Hospital for Sick Children, Crumlin,
Children's University Hospital, Temple Street, Dublin

Dr. Mary Cafferkey
Consultant Microbiologist,
Rotunda Hospital and Children's University Hospital, Temple Street, Dublin

Prof. Luke Clancy
Consultant Respiratory Physician, St. James' Hospital, Dublin,
Medical Director, Peamount Hospital, Dublin

Dr. Kevin Connolly
Consultant Paediatrician, Portiuncula Hospital,
Ballinasloe, Galway

Dr. Kieran Crowley
President, Intensive Care Society of Ireland

Dr. John Devlin
Deputy Chief Medical Officer,
Department of Health and Children

Dr. Lorraine Doherty
Senior Medical Officer (Communicable Disease),
Department of Health, Social Services & Public Safety (Northern Ireland)

Dr. Graham Fry
Lecturer, Tropical Medicine, Trinity College Dublin,
Irish Society of Travel Medicine

Prof. Denis Gill
Professor of Paediatrics,
Royal College of Surgeons in Ireland

Dr. Joan Gilvarry
Medical Director,
Irish Medicines Board

Dr. Howard Johnson
Specialist in Public Health Medicine,
Eastern Regional Health Authority

Prof. T. Joseph McKenna
Registrar, Royal College of Physicians of Ireland

Dr. Dominick P. Natin
Consultant in Occupational Medicine,
Mater Misericordiae and Rotunda Hospitals, Dublin

Dr. Dermot Nolan
Irish College of General Practitioners

Dr. Darina O'Flanagan
Director, National Disease Surveillance Centre

Dr. Jacqueline Quinn
Lecturer, Virus Reference Laboratory,
University College Dublin

Medical Secretary to the Committee:

Dr. Emer Feely
Specialist Registrar in Public Health Medicine

Acknowledgements

Crown copyright material is reproduced with the permission of the Controller of Her Majesty's Stationery Office (HMSO) in relation to extracts from its report entitled "Immunisation Against Infectious Disease".

The Committee wishes to acknowledge its gratitude to HMSO for its permission and assistance in relation to this document.

We also wish to gratefully acknowledge the financial support of the Department of Health and Children and the National Disease Surveillance Centre in the production of this report.

PREFACE

This revised report on immunisation guidelines for Ireland has been prepared with the assistance of an active committee from associated disciplines in Paediatrics, Infectious Diseases, General Practice and Public Health. The report itself is designed to be simple and concise and of course does not claim to contain all information on any pharmacological material. It does, however, give the current information and guidelines concerning immunisation. Vaccines are continually evolving and guidelines will obviously change given the nature of these developments. This is a tribute to the pharmaceutical industry who invest so much money in research and development in this particular field. This document's new loose leaf format will allow it to be regularly updated.

As Chairman of the Committee, I sincerely thank all those who spend so much time and put so much effort into this document. I also wish to thank those who participated in the concerted process, in particular, the chairpersons of each section, Dr. Mary Cafferkey, Dr. Luke Clancy, Dr. Kevin Connolly, Dr. Dominick Natin and Dr. Darina O'Flanagan. These Committees carried out their tasks with much enthusiasm and efficiency. It was indeed a pleasure to work with them. In particular, we must thank our Committee Medical Secretary, Dr. Emer Feely and past medical secretary Dr. Joan O'Donnell, and also Ms. Karen Doyle from the College. We would also like to thank Dr. Rosemary Hone and Dr. Fiona Ryan who proof read the document for their patience and time in delivering the final manuscript.

This document is not designed to be restricted to the medical profession alone and we hope it will be of interest to a broad section of our community involved in the medical, paramedical and tourist industry.

Finally, I would also like to thank the Department of Health and Children and the National Disease Surveillance Centre for their financial support in producing this report.

Brian Keogh, M.D.,
Past President.

Principal changes to this document

This publication is in loose-leaf format this year to allow new pages to be inserted when specific aspects of the guidelines change.

The year in which each of the principal childhood vaccines was introduced to Ireland is indicated at the start of the relevant chapter.

Changes to recommended childhood immunisation schedule

Since the publication of the last version of these guidelines in 1999 there have been a number of changes to the recommended childhood immunisation schedule:

- Immunisation against group C meningococcal disease is now recommended at 2, 4 and 6 months of age as part of the primary immunisation schedule.
- The oral polio vaccine (OPV) has been replaced by inactivated polio vaccine (IPV) in the primary immunisation schedule.
- A 5 in 1 vaccine which contains diphtheria, pertussis, tetanus and polio components mixed with Hib is now available in Ireland.
- A Td booster is now recommended for those aged between 12 and 14 years rather than at school leaving age.
- MMR immunisation is now recommended at 12 - 15 months of age.

New sections

This document has new sections on:

- How to administer an intramuscular/ subcutaneous injection, which includes information on needle size and injection site
- How to hold a child during immunisation
- Vaccines and immunocompromised children
- Vaccines in those with bleeding disorders
- Immunisation of late entrants to the Irish health care system

A list of useful websites for those who require further information about immunisation is also included in Chapter One.

Expanded sections

The chapter on immunisation for health care workers has been expanded. The chapter on MMR has been expanded to three separate chapters on

measles, mumps and rubella.

Amended sections

The protocol for the management of anaphylaxis has been amended with an added section on management of anaphylaxis in a community setting.

The chapters on polio and meningococcal disease have been amended to reflect recent changes to the primary immunisation schedule.

The chapter on tetanus has also been modified to reflect recent changes in advice regarding tetanus prophylaxis.

The chapter on measles has also been changed. Egg allergy is no longer considered a contraindication to MMR vaccination.

Some changes have been made to the hepatitis B chapter. A hepatitis B booster is no longer recommended for immunocompetent individuals who have responded to a primary course.

The chapter on varicella - zoster has been changed and new recommendations have been made about varicella screening and immunisation of health care workers.

CONTENTS

Preface		
Chapter 1	-	General Information
Chapter 2	-	General Immunisation Procedures
Chapter 3	-	Diphtheria
Chapter 4	-	Haemophilus Influenzae Type B (Hib)
Chapter 5	-	Hepatitis A
Chapter 6	-	Hepatitis B
Chapter 7	-	Influenza
Chapter 8	-	Measles
Chapter 9	-	Meningococcal Infection
Chapter 10	-	Mumps
Chapter 11	-	Pertussis
Chapter 12	-	Pneumococcal Infection
Chapter 13	-	Poliomyelitis
Chapter 14	-	Rubella
Chapter 15	-	Tetanus
Chapter 16	-	Tuberculosis
Chapter 17	-	Varicella-Zoster
Chapter 18	-	Immunisation and Health Information for Health Care Workers and Others in At Risk Occupations
Chapter 19	-	Immunisations and Health Information for Travel

Definitions

Adjuvant is a compound used to increase antigenicity and to prolong the stimulatory effect of vaccines particularly of those containing inactivated microorganisms or their products (eg. diphtheria and tetanus toxoids).

Adverse reaction may be defined as one which is harmful and unintended and which occurs at doses normally used in humans for the prophylaxis, diagnosis or treatment of disease or for the modification of physiological function (WHO/EU definition).

Antitoxin is a solution of antibodies derived from the serum of animals immunised with specific antigens (eg. diphtheria antitoxin) used to achieve passive immunity or for treatment.

Immunisation denotes the process of inducing or providing immunity artificially. This may be either active or passive.

- ***Active immunisation*** is the administration of a vaccine or toxoid in order to stimulate the production of antibody or other immune responses.

- ***Passive immunisation*** is the administration of preformed antibodies (such as HNIG, specific antibody preparation and antitoxins) in order to provide temporary immunity.

Immunoglobulin

Human immunoglobulin is that fraction of blood plasma that contains antibodies, notably those against infectious agents. Preparations of immunoglobulin belong to two main categories:

- Human Normal Immunoglobulin (HNIG)
- Human Specific Immunoglobulin/Hyperimmune Globulin.

Toxoid is a modified bacterial toxin that has been rendered non-toxic but has the ability to stimulate the formation of antitoxin.

Vaccine is a suspension of live attenuated or inactivated micro-organisms or fractions thereof administered to induce immunity and thereby prevent infectious disease.

Vaccination is the term used to refer to the administration of any vaccine or toxoid.

Reporting of Adverse Reactions and Quality Defects

All suspected adverse reactions should be reported to the Irish Medicines Board, Block A, Earlsfort Centre, Earlsfort Terrace, Dublin 2, using the Yellow Card System. This is a "Freepost" system and cards are available from the Irish Medicines Board at the above address. Reports should be as detailed as possible and should include the batch number of the vaccine.

A copy of the adverse reaction report form may also be downloaded from the Irish Medicine Board's website at http://www.imb.ie. Completed forms should be posted in envelopes marked "Freepost" and sent to the above address.

Quality defects are also monitored by the Irish Medicines Board, using a similar "Freepost" Green Card System. Quality defects include missing labels/label texts, container defects, altered product appearance, particles in product etc. Full details of the defect and the batch number should be given on the Green Card. Cards are available from the Irish Medicines Board at the above address.

The National Disease Surveillance Centre, 25 - 27 Middle Gardiner Street, Dublin 1 (www.ndsc.ie) is responsible for the surveillance of communicable diseases, examining the incidence of vaccine-preventable illness and examining trends in the uptake in vaccines.

This document is available on the RCPI/ Department of Health and Children websites. The electronic version of the document will be regularly updated as changes are introduced to our immunisation schedule.

Web-sites with further information about immunisation

For further information and debate on immunisation the following web-sites may be useful:

Immunisation Schedule

Table 2.1: Recommended Childhood Immunisation Schedule

[1] A single dose of Hib vaccine is also recommended if the child presents after age 13 months and has had no previous Hib vaccine.
[2] Only for those who are known to be tuberculin negative and have had no previous BCG (see chapter 16).

Available evidence suggests that simultaneous administration of multiple vaccines as in the Irish schedule is not only safe and effective, but can potentially increase uptake rates by up to 17%.

Interrupted Immunisation Courses

If any immunisation course is interrupted, it should be resumed as soon as possible. It is not necessary to repeat the course regardless of the time interval from the previous incomplete course. With Hib and Men C vaccine, the course should be completed with the same brand of vaccine. If this is not possible, another brand may be used to complete the course. Some children for a variety of reasons may not have been immunised, or their immunisation history may be unknown or unreliable. In such cases, special advice should be sought. Advice regarding vaccination of these children can be found later in this chapter.

Late Primary Immunisation

Children who are not immunised and are older than the recommended age range should be immunised as soon as possible. DTaP, MMR, Hib and IPV may be given simultaneously. Injections of non-combination vaccines must be given in separate sites unless otherwise stated in the manufacturers' guidelines. The number of Hib and MenC doses required depends on the child's age (see relevant chapters). Hib vaccine is not recommended for those over four years, DTaP is not recommended over twelve years of age and MenC is not recommended over 22 years of age.

Contraindications and Precautions

NOTE –

1. Sometimes these recommendations differ from those in the manufacturers' data sheets.
2. The benefits and risks of giving specific vaccines should be carefully considered when the events listed as precautions exist.
3. When there are doubts as to whether or not to give a vaccine contact a Paediatrician or Public Health Specialist.
4. Minor illness with a temperature of less than 38°C is not a reason to defer immunisation.
5. Although the risks of giving subsequent doses of pertussis vaccine to a child who has had an event listed under precautions are unknown, the possibility of having another significant reaction may justify omitting pertussis vaccine. However, the decision on whether or not to give pertussis vaccine should be based on the clinical assessment of the earlier reaction, the likelihood of the child being exposed to pertussis infection, and the benefits and risks of the vaccine.

Table 2.2: Contraindications and special precautions for specific vaccines

Vaccine	Contraindications	Precautions
General for all vaccines (DTaP, DT, Td, IPV, Men C, MMR, Hib, HBV, Influenza etc)	-Anaphylactic reaction to a previous dose of that vaccine or to one of its constituents	Moderate or severe illness - defer until recovery, unless the benefits outweigh the risks
DTaP (see Note 5 above)	-Encephalopathy developing within 7 days of previous dose of DTP/ DTaP	-Temp. of > 40.5°C within 48 hrs of previous dose of DTP/ DTaP for which no other cause was established -Seizures within 72 hrs of a previous dose of DTP/ DTaP -Crying lasting >3hrs within 48 hrs of a previous dose of DTP/ DTaP -Hypotonic, hyporesponsive episode within 48 hours of a previous dose
IPV	-Anaphylactic reaction to neomycin or streptomycin	Pregnancy – give if benefits outweigh risks
MMR	-Anaphylactic reaction to gelatin, neomycin -Pregnancy	-Recent administration of blood or immunoglobulin (defer for 3 months) -Immunosuppression -Immune deficiency

Adult Immunisations

Adults should receive the following vaccines:

(a) Women sero-negative for rubella: **rubella**

(b) Previously non-immunised individuals: **polio, tetanus, diphtheria**

(c) Individuals in specific high risk groups: **hepatitis B, hepatitis A, MMR, influenza, pneumococcal and BCG vaccines.** *(See relevant sections)*

(d) Those travelling abroad - see Chapter 19

Intramuscular vaccination in those with bleeding disorders or on anticoagulants

There is little published information regarding the administration of vaccines by the intramuscular route in persons with bleeding disorders or receiving anticoagulant treatment. Vaccines which are licenced for both intramuscular and subcutanenous administration include MMR, hepatitis B and influenza.

Hib, hepatitis A and DTaP vaccines are not licenced for subcutaneous use.

If vaccines are given intramuscularly to those with bleeding disorders it is prudent to use a 23 gauge needle, and to apply pressure to the vaccine site for one to two minutes after the injections.

Administration of vaccines by the subcutaneous route may be considered in those with severe bleeding disorders. However, immunogenicity of vaccines recommended for IM administration may not be as long lasting if they are given subcutaneously.

Live vaccines and pregnancy

Live vaccines should generally not be administered to pregnant women because of the theoretical possibility of harm to the foetus. However, where there is a significant risk of exposure, for example to poliomyelitis, the need for immunisation outweighs any possible risk to the foetus.

Vaccines and immunocompromised children

Over the last number of years there has been an increase in the number of immunocompromised children for a number of reasons such as better survival after cancer chemotherapy and in those with chronic disease such as cystic fibrosis. There is also an increase in the number of those with dysfunctional spleens (sickle cell disease, thalassaemia major) and with HIV because of the HIV pandemic.

The decision on whether or not to give a vaccine to such children must be made on an individual basis, and the risks and benefits carefully weighed. It is important also to realise that the extent of immunocompromise can vary over time, as in those recovering from chemotherapy and those with HIV infection. The following, therefore, are to be regarded as guidelines.

Congenital immune deficiencies:

Persons with B lymphocyte (humoral) defects or complement deficiencies are susceptible to infection with encapsulated bacteriae, especially *Strep. pneumoniae, Haemophilus influenzae* type b, *N. meningitidis* and also to enteroviruses. Those with T-lymphocyte (cell-mediated immunity) defects are susceptible to most viruses and to a number of intracellular bacteria, fungi and parasites.

Live vaccines, either bacterial or viral, should not be used in those with defects in either humoral or cell-mediated immunity, except in those with isolated IgA deficiency when only OPV is contraindicated.

Children with disorders of phagocyte function should not receive live bacterial vaccines. Children with complement deficiency can be given all vaccines.

Inactivated vaccines should be given when indicated, although their immunogenicity may be substantially reduced.

Asplenia:

This may be congenital, post-surgical or functional (sickle cell disease, thalassaemia major, storage disorders etc.) Such persons are at risk of infection caused by encapsulated bacteria (*Strep. pneumoniae, Hib, Meningococci, etc.*) They can receive all routine childhood vaccines. In addition they should be given conjugated pneumococcal vaccine under the age of two years and polyvalent pneumococcal vaccine over the age of two years. They should be re-immunised with this after a period of five years and should also be considered for long-term penicillin prophylaxis.

Bone marrow transplant recipients:

Inactivated vaccines should be deferred for up to 12 months after bone marrow transplant and even then immune response may be sub-optimal. Live vaccines should be deferred for up to two years, and then given only if there is no graft versus host disease or ongoing immunosuppressive treatment.

They should be given DTaP (Td if over the age of ten), Hib and IPV at 12, 14 and 24 months post-transplant. They can be given MMR vaccine at 24 months post-transplant and a second dose one month later.

Cancer chemotherapy:

It is often not possible to give a definite recommendation regarding when to give vaccines after such treatment has been completed. Live vaccines generally should be withheld for at least three months. However the interval may vary depending on the type and intensity of immunosuppressant treatment, radiation treatment, underlying disease etc. An adequate immune response to inactivated vaccines should occur between three and 12 months post treatment.

Corticosteroid therapy:

The minimum amount and the duration of administration of systemic corticosteroids sufficient to cause immune suppression are not well defined. The following are empiric guidelines for administration of **live** virus vaccines to previously healthy persons receiving steroid therapy for non-

immunocompromising conditions:-

1. Topical (skin or inhaled) or locally injected steroid does not usually cause immunosuppression, so live vaccines are not contraindicated.
2. Children receiving less than 2 mgs/kg/day of prednisolone or its equivalent can be given live viral vaccines during treatment.
3. Children getting more than 2 mgs/kg/day of prednisolone or its equivalent, or more than 20 mgs per day for under two weeks, can be given live viral vaccines immediately after treatment is stopped.
4. Children getting over 2 mgs/kg/day of prednisolone or its equivalent, or more than 20 mgs/kg/day, for a period of over two weeks, and those getting 1mg/kg/day for a period of over one month: Live viral vaccines should be deferred for at least one month after stopping treatment, and possibly up to six months.
5. For adults the equivalent dose of prednisolone is 40mg or more per day.

HIV Infection:

Active Immunisation of HIV positive persons

Children with HIV infection, whether symptomatic or asymptomatic, should be immunised with all inactivated vaccines recommended in the primary vaccine schedule – DTaP, Hib, IPV and Men C. Pneumococcal polysaccharide vaccine should be given at two years of age or conjugate pneumococcal vaccine should be given at two, four and six months (see chapter 12). Yearly influenza vaccine beginning at six months is also recommended.

MMR vaccine should be given at 14 months of age to HIV infected children unless they are severely immunocompromised. The second dose should be given one to two months later, in order to ensure seroconversion as early as possible.

Varicella vaccine should be considered for asymptomatic or mildly symptomatic children with CD4 percentages above 25%.

Since the immune response of HIV infected children to all vaccines may be inadequate, these children may be susceptible to vaccine preventable diseases even if they have been vaccinated. Hence, chemoprophylaxis or immunoglobulin treatment should be considered in the event of exposure to these diseases.

Table 2.3 summarises the vaccines recommended and not recommended for these patients.

Table 2.3: Vaccination of those who are HIV positive

There is insufficient evidence at present to recommend the use of OPV, yellow fever or BCG in symptomatic HIV infected individuals.

There is a small risk that BCG given to a symptomatic HIV infected person can result in later disseminated BCG infection. Accordingly, the WHO recommends that BCG be withheld from persons with symptomatic HIV infection. In Ireland less than 2% of HIV positive infants will ultimately prove to be HIV infected. The majority test HIV antibody positive because of the presence of maternal antibodies. They will ultimately lose these antibodies and serorevert to an HIV negative status. Previously, BCG administration was deferred in all of these infants until seroreversion or until PCR testing up to and including that dose at six months of age was negative. This policy has resulted in marked delay in BCG administration and consequently TB infection in some infants.

Routine implementation of HIV-PCR testing means that HIV infection can be reliably diagnosed in over 97% of infected infants by six weeks of age. Thus it is now recommended that if an HIV positive infant has two negative HIV PCR tests in the first six weeks of life, they can and should receive BCG vaccination.

Absence of knowledge of the maternal HIV status is not a contraindiction to BCG vaccination. If maternal HIV status is not readily available it is neither practical nor necessary to pursue its determination prior to BCG immunisation of the infant. In this setting the risk of TB infection exceeds the very small risk of BCG immunisation.

Passive immunisation of individuals with HIV infection

Measles

Vaccine efficacy may be reduced in HIV positive individuals. Human Normal Immunoglobulin (HNIG) may be used for susceptible symptomatic and asymptomatic HIV positive individuals after exposure to measles if the response to vaccination has not been documented or is inadequate.

Tetanus

In the management of wounds classified as tetanus prone, HIV positive individuals should receive Tetanus Immune Globulin (TIG) if the response to vaccination has not been documented or is inadequate.

Varicella

(a) Asymptomatic HIV positive individuals do **not** require Human Varicella-Zoster Immunoglobulin (VZIG) after contact with chickenpox since there is no evidence of increased risk of serious illness in these individuals.

(b) Symptomatic HIV positive individuals should be given VZIG after contact with chickenpox unless they are known to have varicella zoster antibodies.

Live viral vaccines following immunoglobulin administration

Live viral vaccines, with the exception of yellow fever vaccine, should not be given for at least three months following injection of immunoglobulin because the immune response may be inhibited.

General guidelines for spacing the administration of killed and live antigens

The following table shows the recommended minimum intervals between vaccine doses.

Table 2.4: Recommended minimum interval between vaccine doses

Infants who have received hepatitis B vaccine or immunoglobulin on the first day of life can still proceed to get BCG at the normal time.

Immunisation of Late Entrants to Irish Health Care System

Immunisation records of children adopted from developing countries may not be accurate, and should be accepted with caution. Lack of protection against vaccine preventable diseases may be due, not only to erroneous records, but also to improper storage or handling of vaccines, or to immune defects such as those which can occur during severe malnutrition.

Decisions regarding whether to give or withhold vaccines are based on a number of factors, including the risks of over vaccinating children. The following guidelines are based on the best available evidence:

1. MMR:

Because adverse reactions to the MMR vaccine are rare, immunisation is recommended. The two doses should be given between 12-15 months and four to six years of age. For those aged over 15 months of age, two doses should be given at least one month apart. Serological testing may be carried out if there are well-founded concerns about revaccination.

2. Hib:

Because adverse reactions are rare and because it is very unlikely that Hib vaccine would have been given to such children, age appropriate immunisation should be given (see Chapter 4).

3. Polio:

Adverse reactions to IPV are extremely rare. It is recommended that four doses of IPV be given, preferably before the age of four to six years in keeping, as far as possible, with the present Irish schedule.

4. DTaP:

Excessive doses of each of the components may result in a severe local (arthus) reaction. If a major local or systemic reaction occurs after the first dose, tetanus and diphtheria antibody levels should be checked. A high level indicates that doses two or three are not necessary. However a booster DTaP should be given at four to six years. If a child at presentation is over ten years of age Td is given (see Chapter 15).

If it is likely that three or more doses of DTaP have been given, serological testing for specific IgG antibodies to diphtheria and tetanus is reasonable.

Conditions which are NOT contraindications to immunisation

1. Family history of any adverse reactions following immunisation.
2. Minor infections without fever or systemic upset.
3. Family history of convulsions. Appropriate antipyretic measures are advisable following immunisation of children under five years with a family history of febrile convulsions.
4. History of pertussis, measles, rubella or mumps infection in the absence of proof of immunity.
5. Prematurity or low birth weight.
6. Stable neurological conditions e.g. cerebral palsy.
7. Contact with an infectious disease.
8. Asthma, eczema, hay fever, migraine and food allergy.
9. Therapy with antibiotics or low dose oral or locally-acting steroids.
10. Child's mother is pregnant.
11. Child being breastfed.
12. History of jaundice after birth.
13. Child over the age recommended in immunisation schedule.
14. Recent or imminent surgery.
15. Corticosteroid replacement therapy.

Immunoglobulins

Human Normal Immunoglobulin (HNIG) is prepared from the pooled blood of donors who are negative to hepatitis B surface antigen (HBsAg), hepatitis C antibody (anti-HCV) and antibody to human immunodeficiency virus (HIV).

Human Normal Immunoglobulin (HNIG) *for intramuscular use*

HNIG usually contains antibodies to varicella, hepatitis A and other viruses currently prevalent in the population. It is available in 2, 5 and 10 ml vials. It is given by deep intramuscular injection. It should be stored at 0-4°C and the expiry date on the package observed. Unused portions of an ampoule must be discarded. As recipients of intramuscular immunoglobulin can experience local pain and discomfort at the injection site, it should be administered deep into a large muscle mass, such as the gluteal region. Ordinarily, no more than 5ml should be administered at any one site. Intramuscular HNIG should not be administered to any patient with severe thrombocytopenia or with a coagulation disorder. Caution should be exercised with any patient who has a history of adverse experience following HNIG administration.

Indications for use of HNIG include post-exposure prophylaxis or modification of hepatitis A infection and post-exposure modification of measles infections.

HNIG may interfere with the immune response to live viral vaccines; these should not therefore be given from at least three weeks before to at least three months after an injection of HNIG. Yellow fever vaccine is an exception, as HNIG obtained from donors is unlikely to contain antibody to this virus; a similar situation applies to OPV when given as a booster dose.

If an interval of three weeks is not possible (as in some cases of travellers going abroad), live viral vaccines may be given simultaneously with the immunoglobulin product, while recognising that vaccine induced immunity may be compromised. The vaccine and HNIG should be given in different limbs. If indicated, vaccination should be repeated approximately three months later.

Specific Immunoglobulins

At present specific immunoglobulins are available for administration following exposure to tetanus, hepatitis B, rabies* and varicella zoster virus. They are prepared from the pooled plasma of blood donors who have high antibody titres to specific infections. Recommendations for their use are found in the relevant sections.

* At present available from C.D.S.C., 61 Colindale Avenue, London NW9 5EQ, Tel. 00 44 208-200-6868.

When medicinal products prepared from human blood or plasma are administered, infectious diseases due to the transmission of infective agents cannot be totally excluded. This applies also to pathogens of hitherto unknown origin and pathogens as yet unidentified.

To reduce the risk of transmission of infective agents, stringent controls are applied to the selection of blood donors and donations. In addition, virus removal and/or inactivation procedures are included in the production process.

The current procedures applied in the manufacture of medicinal products derived from human blood or plasma are effective against enveloped viruses such as HIV, hepatitis B and hepatitis C viruses.

Storage and Transport of Vaccines

Manufacturers' recommendations on storage must be observed and care

should be taken to ensure that, on receipt, vaccines are immediately placed under the required storage conditions. Vaccines are temperature sensitive and the following guidelines on the correct temperatures and procedures for storage and transport of vaccines should be adhered to:

1. Transport vaccines in a cool bag or cool box and refrigerate as soon as possible.
2. Use a maximum-minimum thermometer to ensure that the temperature does not go above or below the safe range of 2-8°C. The temperature must be recorded on a daily basis.
3. Do not pack the refrigerator too tightly. Room should be allowed for cold air to circulate.
4. Check the expiry dates of vaccines and use the oldest first.
5. Defrost the refrigerator regularly if necessary. Remember to keep the vaccines in another refrigerator or cool box while doing this.
6. Do not store vaccines in the same refrigerator as food.
7. Ensure that the refrigerator cannot be switched off accidentally. Tape the plug in place; use a large notice and / or a refrigerator alarm.
8. If the refrigerator is accidentally switched off:-
    - Keep the door closed
    - Find out how long it has been switched off for and check the temperature
    - Contact your local health board pharmacy for further advice if necessary.
9. Designate an individual to be in charge of the refrigerator.
10. The refrigerator should be cleaned every two months with sodium hypochlorite diluted to a 1:10 solution. In the event of accidental breakage or spillage of vaccine, the sodium hypochlorite should not be diluted.

The above guidelines should be clearly displayed on the refrigerator.

Usage and Disposal of Vaccines

Unused vaccine or partly used vials should be disposed of safely, preferably by heat inactivation or incineration. Contaminated waste and spillage should be dealt with by heat sterilisation, incineration or chemical disinfection as appropriate.

Reconstituted vaccine must be used within the recommended period. Single dose containers are preferable; multi-dose vials, once opened, must be discarded after use.

How to administer intramuscular (IM) injections

Table 2.5 Recommendations regarding preferred site and needle size for intramuscular injections

Patient's age	Site (see illustrations below)	Needle size
Infants (birth to 12 months of age)	Vastus lateralis muscle in anterolateral aspect of middle or upper thigh	25mm needle 22-25 gauge
Toddlers (12 to 36 months of age)	Vastus lateralis muscle preferred until deltoid muscle has developed adequate mass (approximately age 36 months)	16*-30mm needle 22-25 gauge (*16mm use only in deltoid site for 12-15 months)
Toddlers (>36 months of age), children and adults	Densest portion of deltoid muscle - above armpit and below acromion	25-30mm needle 22-25 gauge

Needle insertion

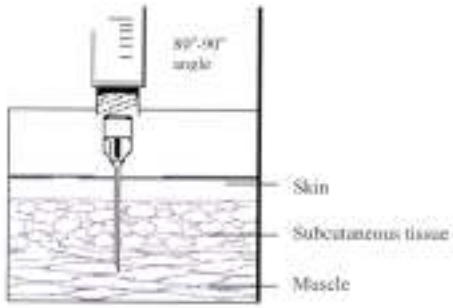
Use a needle long enough to reach deep into the muscle.

Insert needle at an 80° to 90° angle to the skin with a quick thrust.

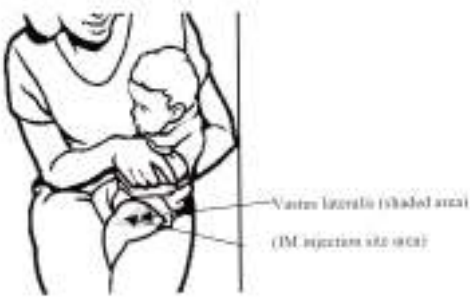
Retain pressure on skin around injection site with thumb and index finger while needle is inserted.

Pull back slightly on plunger to make sure needle has not entered a vein. If blood appears remove and discard. Repeat at new site.

Multiple injections given in the same limb should be separated by at least 2.5cms.

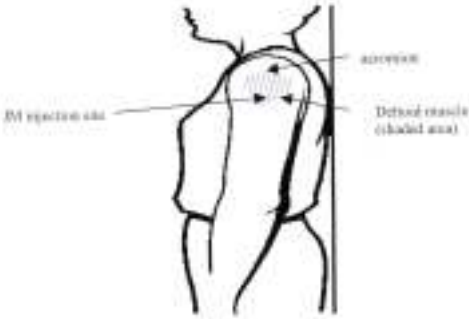


IM site for infants and toddlers (birth to 36 months of age)



Insert needle at 80-90° angle into anterolateral aspect of middle or upper thigh.

IM site for older toddlers, children and adults



Insert needle at 80-90° angle into densest portion of deltoid muscle – above armpit and below acromion.

How to administer subcutaneous (SC) injections

Table 2.6 Recommendations regarding preferred site and needle size for subcutaneous injections

Patient's age	Site (see illustrations below)	Needle size
Infants (birth to 12 months of age)	Fatty area of the anterolateral thigh	16mm needle 23-25 gauge
Toddlers (12 to 36 months of age)	Fatty area of the anterolateral thigh or outer aspect of upper arm	16mm needle 23-25 gauge
Children and adults	Outer aspect of upper arm	16mm needle 23-25 gauge

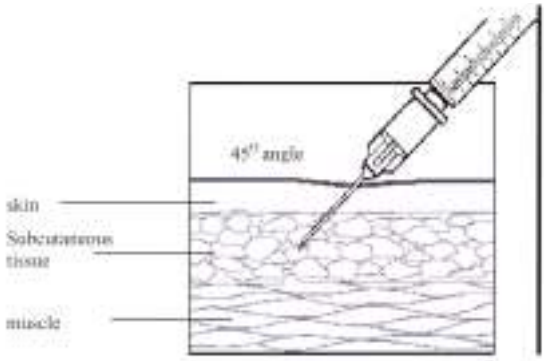
Needle insertion

Insert needle at 45° angle to the skin.

Pinch up on SC tissue to prevent injection into muscle.

Pull back slightly on plunger to make sure needle has not entered a vein. If blood appears remove and discard. Repeat at new site.

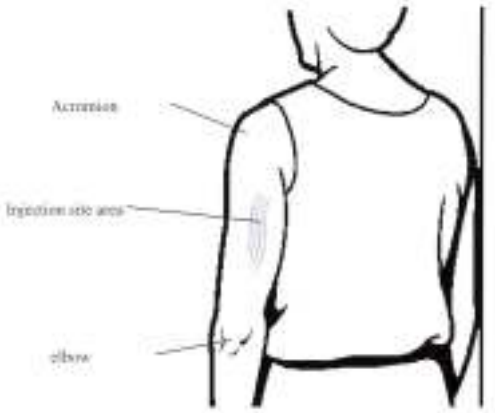
Multiple injections given in the same limb should be separated by at least 2.5cms.



SC site for infants and toddlers (birth to 36 months of age)

Insert needle at 45° angle into fatty area of anterolateral thigh. Make sure you pinch up on SC tissue to prevent injection into muscle.

SC site for toddlers, children and adults



Insert needle at 45° angle into outer aspect of upper arm. Make sure you pinch up on SC tissue to prevent injection into muscle.

How to hold a child during immunisation

This method involves the parent in embracing the child and controlling all four limbs. It avoids “holding down” or overpowering the child, but it helps you steady and control the limb of the injection site.

For infants and toddlers:

Have parent hold the child on parent’s lap.

1. One of the child's arms embraces the parent's back and is held under the parent's arm.

2. The other arm is controlled by the parent's arm and hand. For infants, the parent can control both arms with one hand.

3. Both legs are anchored with the child's feet held firmly between the parent's thighs, and controlled by the parent's other arm.

For older children:

Hold the child on parent’s lap or have the child stand in front of the seated parent.

1. Parent's arms embrace the child during the process.

2. Both legs are firmly between parent's legs.

Introduction

Diphtheria is an acute infectious disease affecting the upper respiratory tract and occasionally the skin, caused by *Corynebacterium diphtheriae*. Effective protection against the disease is provided by active immunisation. Since the introduction of vaccination against diphtheria, the disease and the organism have been virtually eliminated from Ireland. However, an immunisation rate of over 90% must be maintained to protect the population against the possibility of a resurgence of the disease which could follow the introduction of cases or carriers of toxigenic strains from overseas.

Epidemiology

Humans are the only known reservoir of *Corynebacterium diphtheriae*. Transmission results primarily from close contact with a patient or carrier. Spread is by droplet infection and rarely through contact with articles soiled by fomites. The incubation period is usually from two to five days, but can occasionally be longer. The disease is communicable for up to four weeks, but carriers may shed the organism for longer. Diphtheria is a serious infectious disease, which is notifiable, and if suspected, immediate contact should be made with the appropriate Health Board Department of Public Health.

Effects of diphtheria

The disease is characterised by an inflammatory exudate which forms a greyish membrane in the upper respiratory tract resulting in nasopharyngitis and/or obstructive laryngotracheitis. These local manifestations are associated with a low-grade fever and the gradual onset of generalised manifestations over one to two days. Cutaneous manifestations are less common. A toxin is produced by diphtheria bacilli which affects particularly myocardial, nervous and adrenal tissues and may result in life-threatening complications including myocarditis and neurological problems such as vocal cord paralysis and ascending paralysis similar to the Guillain-Barré syndrome.

Diphtheria toxoid

Diphtheria immunisation protects by stimulating the production of antitoxin which provides immunity to the effects of the toxin.

The antigens currently available for immunisation are:

- Adsorbed diphtheria/tetanus/pertussis (DTaP)
- Adsorbed diphtheria/tetanus (DT or Td)

Toxoid should be stored at 2-8°C.

Indications

Immunisation of infants and children under ten years

Primary Immunisation

Diphtheria toxoid as a component of the combination 5 in 1 vaccine is recommended for infants from two months of age. If the pertussis component is contraindicated, adsorbed diphtheria/tetanus toxoid should be used. The primary immunisation course consists of three doses given at two, four and six months of age (see immunisation schedule, Chapter 2). Three doses of DTaP should be given by deep subcutaneous or intramuscular injection at intervals of at least one month. If a course is interrupted it may be resumed without the necessity to start again.

Booster Immunisation

A booster dose of diphtheria and tetanus toxoids DTaP is recommended at four to five years of age. Booster doses should be given at least three years from the last dose of the primary course unless there is a documented history of five doses of tetanus toxoid having been given or the child is over ten years of age. A further booster using low dose diphtheria toxoid (Td) is recommended at 12-14 years.

Dose and route of administration

For primary immunisation of children under ten years the dose is 0.5ml given by intramuscular or deep subcutaneous injection into the deltoid region or the anterolateral thigh.

Immunisation of persons aged 10 years and over (unimmunised)

Primary Immunisation

A special low dose diphtheria toxoid must be used because of the possibility of a serious reaction in an individual who is already immune. The only licensed preparation is one combined with tetanus toxoid (Td, Diftavax). Three doses of Td should be given by deep subcutaneous or intramuscular injection at intervals of one month.

Booster Immunisation

Low dose diphtheria toxoid must be used. Td is recommended unless there is a documented history of a fifth dose of tetanus toxoid having been given within the previous ten years (see Chapter 15), when low dose diphtheria toxoid only should be used which is available on a named patient basis. In

such circumstances, specialist advice should be sought or the Irish Medicines Board contacted. It should also be considered for administration to those going to countries in which cases of diphtheria have recently occurred.

Contraindications

Anaphylactic reaction to a preceding dose, if it is thought that the diphtheria component caused the preceding reaction.

Precautions

Vaccination should be postponed if the intended recipient has an acute febrile illness with a temperature over 38°C.

HIV positivity

HIV positive individuals may be immunised against diphtheria in the absence of any contraindications.

Adverse reactions

Local: Transient local reactions (pain, palpable lump, erythema) may occur in over 50% of recipients of DT or Td. Sequelae are rare.

General: Malaise, transient fever and headache may occasionally occur. Dyspnoea, urticaria, angioedema, anaphylaxis and neurological reactions are very rare.

Contacts of a diphtheria case or carriers of a toxigenic strain

Table 3.1 Recommendations for vaccination of contacts of diphtheria cases and carriers

*These children may also require IPV

Non-immunised contacts of a case of diphtheria should, in addition, be given a prophylactic course of erythromycin, 20-30 mgs/kg, 12 hourly for seven days, up to a maximum of 1g per dose.

Introduction

Infections due to *Haemophilus influenzae* are an important cause of morbidity and mortality, especially in young children. The Hib vaccine was introduced into Ireland in 1992 and there has subsequently been a dramatic fall in the incidence of invasive Hib disease. The vaccine is specific for diseases caused by *H. influenzae* type b, and does not protect against infections caused by other haemophilus strains.

Epidemiology

Almost all invasive *H. influenzae* infections are caused by encapsulated strains, of which there are six serotypes (a-f). Type b (Hib) causes 80% of these infections. Non-encapsulated strains of haemophilus cause mucosal infection (e.g. otitis media) but rarely lead to serious invasive disease.

After 12 months of age, the incidence of Hib disease steadily declines. Approximately 95% of all Hib disease occurs before the age of five years. The disease is spread by droplet infection from person to person.

Effects of Hib

Clinical manifestations of invasive infection with *H. influenzae* include meningitis, otitis media, epiglottitis, septicaemia, septic arthritis, cellulitis and osteomyelitis. The most common presentation of invasive Hib disease is meningitis, frequently accompanied by bacteraemia. The risk of complications is greatest in children aged 6-12 months. Up to 5% of infants with haemophilus meningitis die and others may be left with neurological sequelae including deafness.

Hib vaccines

Hib vaccines presently available consist of *Haemophilus influenzae* b capsular poly or oligo-saccharide conjugated with either tetanus or diphtheria toxoids. They are given combined with DTaP and IPV vaccines in the same syringe. The primary course should start at two months of age. For those aged from two to 12 months, three injections are given at two

month intervals. Children aged 13 to 48 months require only one dose. Immunisation is not normally required over four years of age.

Very high efficacy has been reported using such a schedule, and antibody has been shown to persist in sufficient concentrations to protect against Hib disease.

All Hib vaccines currently in use are inactivated. Vaccine should be stored at 2-8°C but not frozen. When the product brand given in the first and second courses is not known or not available, the three dose series can be completed with any Hib vaccine currently licensed.

Dose and Route of Administration

The dose is 0.5 ml given by intramuscular injection. If BCG has been given within the previous three months, a different limb should be used.

Hib Immunisation Schedule

Table 4.1: Recommendations for Hib immunisation

Age at first Immunisation	Number of doses	Interval between doses
2-12 months 13-48 months	3 1	2 months –

Indications

1. All children under four years of age. Hib vaccine may be given at the same time as DTaP, MMR and IPV.
2. A child aged under two years of age who develops invasive Hib disease should be given Hib vaccine after one month. Children aged 24 months or older who develop invasive Hib disease do not need to be immunised because the disease would most likely have induced a protective immune response.
3. Persons with functional or anatomical asplenia, irrespective of age, should be vaccinated according to the schedule above.
4. Children who have completed a primary series and are undergoing elective splenectomy may benefit from an additional dose of Hib vaccine given two weeks prior to the operation.

Contraindications

1. Previous anaphylactic reaction to any component of the vaccine.

Precautions

1. Acute febrile illness. Immunisation should be postponed until the illness has resolved.

Hib vaccine may be given to immunocompromised patients, but adequate antibody levels may not be reached.

Adverse reactions

Local: These include local redness, warmth or swelling at the injection site. Mild local reactions occur in about 20% of children.

General: Systemic reactions are uncommon and include fever, irritability, headache, vomiting, diarrhoea and rashes. Seizures have rarely been reported.

Immunisation and chemoprophylaxis of cases and contacts of invasive Hib disease

1. Household contacts (except pregnant women):-
   Non-immunised contacts aged less than four years should be given Hib vaccine. Chemoprophylaxis is indicated for all household contacts irrespective of age or immunisation history **IF** there are one or more children aged under four years who are unvaccinated or incompletely vaccinated.

2. Play-group or creche contacts:-
   When a case occurs in this setting, non-immunised contacts aged under four years should be given Hib vaccine. When **two or more cases** occur within two months chemoprophylaxis should be offered to all room contacts, both adults and children.

3. Index Case:-
   The index case, if younger than two years of age, should be immunised according to the current recommended schedule irrespective of their vaccine history, starting one month after onset of disease or as soon as possible thereafter. This is because children who have invasive Hib infection under two years of age may have low levels of anticapsular antibodies and could get a second episode of disease.

   The index case should also be given chemoprophylaxis prior to discharge if not treated with cefotaxime or ceftriaxone. These drugs eradicate Hib from the nasopharynx. Immunised children who develop invasive Hib disease have a higher incidence of IgG_2 deficiency and therefore should be considered for immunological evaluation.

NOTES:

1. Rifampicin dose for prophylaxis:
   (a) Neonates and infants under one year of age – 10 mg/kg once daily for four days
   (b) Children over one year of age – 20 mg/kg once daily for four days, max. 600 mg/day
   (c) Adults - 600 mg once daily for four days

2. Prophylaxis is not recommended for pregnant women who are contacts of cases because the effects of rifampicin on the foetus have not been established.

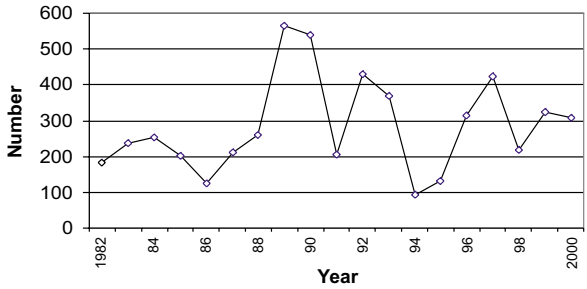
Introduction

Hepatitis A virus (HAV) infection is a significant health problem world-wide and in Ireland accounts for most clinical cases of hepatitis. HAV hepatitis is endemic in many areas of the world and epidemics also occur. Usually a benign disease, hepatitis A may have a protracted or relapsing course and may trigger autoimmune chronic active hepatitis or, rarely, fulminant hepatic failure.

Until the introduction of hepatitis A vaccine in 1992 protection against hepatitis A depended on high standards of public health and hygiene and selective passive immunisation of those at high risk of infection using human normal immunoglobulin (HNIG). Now active immunisation confers longer and more effective protection.

Epidemiology

Figure 5.1 Hepatitis A notifications 1982-2000, Republic of Ireland



The incidence of hepatitis A shows a cyclical pattern in Ireland as demonstrated in Figure 5.1. The average notified annual incidence from 1991 to 2000 was 7.8 per 100,000 population. In the developing world where standards of sanitation are poor, HAV infection is common in early life, is usually sub-clinical and confers life long immunity. For example, in Africa most ten year old children are naturally immune. As standards improve, infection in early life is less common and most adults are susceptible e.g. in a recent Irish study, 63% of those aged under 60 years were susceptible.

Transmission

Person to person transmission

The most common routes of infection are through person to person contact. The risk of faecal-oral transmission is increased where there is close person to person contact eg. among infants, young children and those with learning disabilities, especially in day care and residential homes and where there is overcrowding and poor hygiene standards.

In most infected persons viral titres are highest in stool during the one to two weeks prior to the onset of illness and transmissability is most likely at this time. The risk diminishes thereafter and is minimal by one week after the onset of jaundice. Virus may however continue to be shed for longer periods particularly in infants and young children.

Less common modes of transmission

Food and water contamination

Contamination of water supplies with infected faeces occurs where sewage disposal is inadequate. Food washed in contaminated water or prepared by an infected subject may cause viral transmission and infection. Shellfish from contaminated sea water may also cause outbreaks.

Percutaneous-intravenous transmission

A viraemia occurs briefly during HAV infection. Outbreaks of hepatitis A have rarely been linked to blood and blood product administration. The increased incidence of infection among intravenous drug users is probably due to poor standards of hygiene, rather than intravenous transmission.

Sexual transmission

Hepatitis A infection may be transmitted by sexual oral-anal contact or by oropharyngeal secretions.

Effects of HAV

Infection with HAV varies from subclinical infection, through clinical hepatitis with or without jaundice, to fulminant disease, coma and death. In children under six years of age, most (70%) infections are asymptomatic. During the incubation period (range 2-6 weeks), virus replicates in the liver and is shed in the faeces. Faecal excretion declines when symptoms develop and usually ceases within two weeks of the onset of jaundice. The frequency and severity of symptoms increase with age, and the illness usually lasts a few weeks. Chronic liver disease is very unusual but HAV infection may cause prolonged cholestatic jaundice, relapsing hepatitis, or very rarely fulminant hepatitis. The mortality may approximate 2% in those over the age of 50 years.

Hepatitis A vaccine

Hepatitis A vaccine is a formaldehyde inactivated vaccine prepared from hepatitis A virus and conjugated to aluminium hydroxide. The vaccine should be stored at 2-8° C but not frozen and should be protected from light.

After one dose, approximately 95% of subjects acquire protective levels of HAV antibodies and over 99% after the second dose. It is expected that immunity for at least ten years is conferred by the full course.

Dose and route of administration

Hepatitis A vaccines should be given intramuscularly in the deltoid region. For patients with severe bleeding tendencies (eg. persons with haemophilia), subcutaneous injection may be considered. Hepatitis A vaccines should not be administered intravenously.

Adults

(1) Havrix Monodose (GlaxoSmithKline) *(16 years and older)*
Primary immunisation consists of a single dose (1440 ELISA units) given intramuscularly. A booster at 6-12 months is recommended to prolong immunity. It is given intramuscularly in the deltoid region.

(2) Twinrix Adult (GlaxoSmithKline) *(16 years and older)*
A combined inactivated hepatitis A vaccine and rDNA hepatitis B vaccine is available for use in non-immune adults and adolescents over 16 years of age who are at risk of both hepatitis A and hepatitis B infection. Three doses are recommended (see table 5.1).

Children/adolescents

(1) Havrix Junior monodose vaccine *(1-15 years)*
The dose is half the adult dose (720 ELISA units - 0.5 ml).

(2) Twinrix Paediatric *(1-15 years)*
This is a similar preparation to Twinrix Adult for children under 16 years of age. Three doses are recommended.

The VAQTA adult and paediatric hepatitis A vaccines were withdrawn from the Irish market in November 2001 due to reduced potency.

Hepatitis A immunisation schedule

Table 5.1 Hepatitis A immunisation schedule for currently available vaccines
**All by deep intramuscular injection in deltoid region*

Indications

Active immunisation with Hepatitis A vaccine is recommended for

- Susceptible travellers, including children, to high-risk areas, (Africa, Asia, South America, possibly Southern and Eastern Europe). Vaccination should be carried out two or more weeks before departure. However if the time before departure is short, the vaccine is still considered likely to prevent or at least modify the infection (see Chapter 19). HNIG is recommended for travellers who are immunocompromised and should be given at a separate site
- Susceptible patients with chronic liver disease. This includes intravenous drug users with chronic liver disease. Non-immune patients with persistent hepatitis B and hepatitis C infection should be immunised against hepatitis A
- Persons with haemophilia and recipients of plasma-derived clotting factors

- Laboratory workers who culture hepatitis A or health workers in units with continued occurrence of symptomatic cases
- Those with recent close contact with infected individuals (see *Post exposure prophylaxis*, below).

Other high risk non-immune groups may be considered for immunisation:

- Child care workers especially if there is evidence of an ongoing outbreak in a child care centre
- Staff and residents at institutions for persons with learning disabilities
- Men who have sex with men especially if there is evidence of an ongoing outbreak
- Sewage workers exposed to raw untreated sewage
- Prison officers and inmates in institutions where HAV infection is occurring
- Those with renal failure prior to dialysis
- Homeless people
- Staff who work with homeless people
- Susceptible staff who work with non-human primates that are susceptible to hepatitis A infection
- Solid organ transplant recipients who have not been immunised previously should be immunised prior to transplantation.

For those aged over 50 years or with a history of jaundice, haemophilia or residence in a high-risk area, then screening for immunity to hepatitis A is advised before immunisation. If the blood test confirms immunity to hepatitis A, immunisation is not needed.

Contraindications

Vaccination is contraindicated in an individual who had anaphylaxis or a severe reaction to a previous dose. Safety data in pregnant women are not available, but the risk is considered to be low or nonexistent because the vaccines contain inactivated purified viral proteins.

Adverse reactions

Side effects are infrequent and mild.

Post exposure prophylaxis

Hepatitis A vaccine should be used for preventing secondary cases and outbreaks, provided that patients are informed that vaccine should be given as close to the time of exposure as possible and that the latest date the

vaccine is likely to be effective in preventing disease in contacts is probably seven days from onset of illness in the primary case. Use of vaccine after this time may be considered to prevent tertiary infection.

HNIG should be offered (if available) in addition to or in preference to vaccine for contacts who are more than seven days from onset of illness in the primary case, and for those at risk of adverse outcome for hepatitis A infection. Individuals at particular risk of an adverse outcome to hepatitis A infection include those aged more than 50 years old, with liver cirrhosis of any cause, or with pre-existing hepatitis infection. When HNIG is given within two weeks of exposure, it is more than 85% effective in preventing hepatitis A. In general the use of HNIG more than two weeks after the last exposure is not indicated.

Ideally, same or next-day immunoprophylaxis should be given to family, household and sexual contacts considered at risk of exposure to the primary case. Serological testing of the contacts is usually not recommended as it may delay administration of prophylaxis.

- **Child care centre staff, children, and their household contacts.** If one or more hepatitis A cases are associated with a centre, immunoprophylaxis (as above) should be offered to the children and the adult carer(s) in contact with the index case. If the centre admits children in nappies, immunoprophylaxis should be offered to all children and staff in the centre. Where HAV infection is confirmed in two adult contacts of children attending such a centre, immunoprophylaxis should similarly be offered to all children and staff. When an outbreak occurs (i.e. hepatitis cases in three or more families) immunoprophylaxis also should be considered for members of households that have children in nappies. As hepatitis A vaccine does not have product authorisation for children of < 1 year, HNIG is recommended for this group.
- **Schools, hospitals and work settings.** Immunoprophylaxis is not normally indicated when a single case occurs in a school, office or other work setting. Immunoprophylaxis as above should be offered to persons with close contacts with index patients if an epidemiological investigation indicates HAV transmission has occurred
- **Food or waterborne outbreaks.** If a foodhandler is diagnosed with hepatitis A, immunoprophylaxis should be offered to other food handlers at the same location. Administration of immunoprophylaxis to patrons should only be considered during the time the food handler was likely to be infectious, if the food handler had both directly handled uncooked foods or foods after cooking and had diarrhoea or bad hygiene practices.

Introduction

Hepatitis B is an important cause of serious liver disease including acute and chronic hepatitis, cirrhosis and primary hepatocellular carcinoma. Hepatitis B virus is believed to be second only to tobacco among human carcinogens.

Epidemiology

In areas of the world such as Africa, parts of South America and parts of Asia the disease is highly endemic (more than half the population may have been infected with the virus and up to 20% are chronically infected carriers). In Europe, prevalence of serological markers of chronic carriage (surface antigen, HBsAg) is estimated to be 0.1 – 2%, but rises steeply from north to south, and from west to east, reaching a peak in Mediterranean and in Eastern European countries. The United Kingdom and other Northern European countries have a low prevalence of hepatitis B infection; less than 8% of the native population have serological markers of previous hepatitis B infection (such as anti-core antibody), and hepatitis B surface antigen carriage rates are between 0.1 and 0.5%.

In Ireland at present, prevalence of serological markers of hepatitis B infection is low. A national study in the general population in 1999 estimated the prevalence of past exposure to hepatitis B (anti-core antibody) to be 0.51%. About 1 in 7700 (0.0001%) new blood donors tested positive for HBsAg during the period 1998-2000, having fallen from 1 in 4000 (0.026%) in the period 1993-1997, and 1 in 1700 (0.058%) in the period between 1980 and 1991. Also 1 in 2000 to 1 in 6000 pregnant Irishborn women are HBsAg positive, depending on the population.

Figure 6.1 Number of statutory notifications of viral hepatitis B, 1982 - 2000

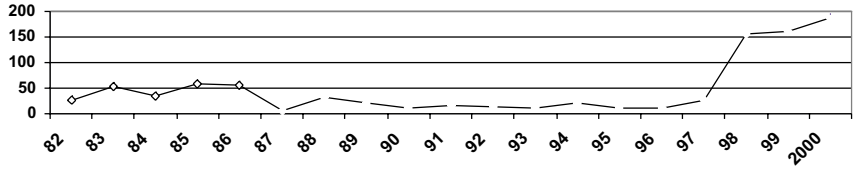
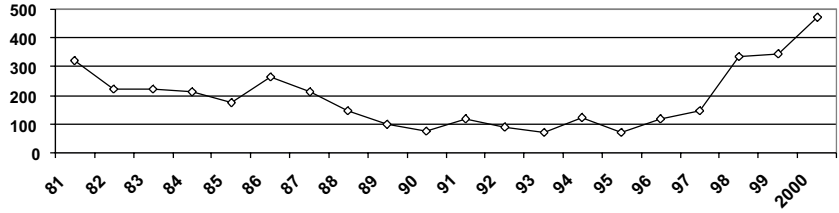


Figure 6.2 New cases of hepatitis B (surface antigen positive) identified by Virus Reference Laboratory 1981 - 2000



surveyed. The prevalence of hepatitis B anti-core antibody in Irish prisoners in 1998 was 8.7% overall and in injecting drug-using prisoners was 18.5%. Homeless people also have evidence of increased exposure to hepatitis B with a prevalence of anti-core antibody of 9% in a study performed in Dublin in 1999-2000. Figure 6.1 shows the number of statutory notifications of viral hepatitis B in Ireland, 1982-2000. The increase in notifications since 1998 may be largely attributed to the introduction of active screening in high-risk populations. In particular, screening in reception centres in 1999 and 2000, of immigrants from high endemicity countries has revealed a HBsAg positivity rate of 4 - 5%. It is clear when comparing data from the Virus Reference Laboratory (Figure 6.2) with the statutory notification data that there is significant undernotification of hepatitis B.

Under the Infectious Disease Regulations 1981 all cases of hepatitis B should be notified to the Department of Public Health in each Health Board.

Transmission

HBV is transmitted parenterally and sexually. Transmission most commonly occurs as a result of blood to blood contact, including injury with contaminated needles or sharps and sharing of needles by injecting drug users. It can also be transmitted directly from an infected mother perinatally. Transmission has also followed bites by infected persons. HBV has been found in virtually all body secretions and excretions; however only blood (and serum-derived fluids), saliva, semen and vaginal fluids have been shown to be infectious.

Effects of HBV

1. Acute hepatitis B varies in its severity from inapparent infection to fulminating fatal hepatic necrosis.
2. Between 2-10% of infected adults become carriers. A carrier may be defined as someone who is hepatitis B surface antigen (HBsAg) positive

on at least two occasions, at least six months apart. Those in whom hepatitis B e antigen (HBeAg) is detectable (indicating active viral replication) are most infectious. The chronic carrier state is more likely to occur following infection in childhood, and may affect 90% of infants who are infected perinatally.

3. A proportion of carriers goes on to develop chronic hepatitis, cirrhosis or hepatocellular carcinoma.

Hepatitis B Vaccine

The vaccines in use are recombinant vaccines grown in yeast.

Indications

In hyperendemic areas of the world and in areas of moderate endemicity only widescale immunisation of infants and children can be expected to produce significant disease control. In 1992, the World Health Organisation recommended integration of hepatitis B vaccine into all national programmes by 1997. As a means of controlling hepatitis B infection, in areas of lower prevalence many countries, including Ireland, have adopted a policy of vaccinating high-risk groups. Strengthened surveillance of hepatitis B, supported by population based epidemiological studies, is necessary to monitor the effectiveness of the current policy. Laboratory reporting to Public Health Departments followed by enhanced epidemiological surveillance and management of contacts is required in all cases.

Despite evidence of undernotification, examination of the recent epidemiological data in Ireland indicates a low prevalence of hepatitis B in line with other Northern European countries. Therefore immunisation is recommended only for individuals who are at increased risk of hepatitis B because of their occupation, lifestyle or other factors (e.g. close contact with a case or carrier). In order to ensure success of this targeted approach, it is essential that a high compliance be achieved in these target populations. Responsibilities and structures for the implementation of this programme should be clearly designated. Uptake of immunisation in the target group should be regularly audited. The policy on hepatitis B immunisation will continue to be reviewed in the light of changing epidemiological data and evidence of the effectiveness of delivery of the hepatitis B immunisation programme.

Ideally, immunisation should be carried out before the risk of exposure to HBV (pre-exposure prophylaxis) but it may also follow exposure (post-exposure prophylaxis).

Pre-exposure prophylaxis

The following groups should receive hepatitis B vaccine if non immune:

1. **Health care personnel**

- Doctors, nurses, dentists, midwives, laboratory staff, mortuary technicians, ambulance personnel, cleaning staff, porters, medical and dental students, health care professionals and anyone who is at particular risk through contact with blood or body fluids.

2. **Patients and family contacts**

- The spouses, sexual partners, family and household contacts of acute cases and carriers of HBV if the potential recipient is non immune (anti HBc negative)
- Families adopting children from countries with a high prevalence of hepatitis B. These children should be tested for hepatitis B markers and the household contacts offered immunisation if required, preferably before the adoption
- Babies born to mothers who are chronic carriers of hepatitis B virus or to mothers who have had acute hepatitis B during pregnancy
- People with haemophilia and those receiving regular transfusions
- Patients and carers in institutions for those with intellectual disability (including day care facilities)
- Patients with chronic renal failure are at risk of acquiring hepatitis B and their response to immunisation is poor. As it is anticipated that they may require dialysis or transplantation, early immunisation of patients with evolving chronic renal failure is advised
- Patients with chronic hepatitis, including persistent hepatitis C infection, if susceptible should be vaccinated against hepatitis A and B.

3. **Security and emergency services personnel**

4. **Susceptible members of high risk groups**

- Individuals who change sexual partner frequently, particularly homosexual and bisexual men, and men and women who are sex workers
- Intravenous drug users

- Prisoners
- Tattoo artists
- Immigrants from, or travellers to, areas with a high prevalence of HBV
- Homeless people.

Routine postvaccination testing for anti-HBs is recommended 2-4 months after the third vaccine dose for persons who are at continuing risk of exposure.

Table 6.1: Actions required following post vaccination testing

Anti - HBs level	Action required
0 or <10 miu/ml	Non responder*. Exclude past infection or chronic carriage. Repeat 3 dose course of hepatitis B vaccine (a different brand of vaccine may be considered) **Double dosing should also be considered.** Recheck Anti-HBs at 2-4 months post completion.
10-99 miu/ml	Poor responder. Immediate booster and retest at 2-4 months using 2 assays; if both assays are >10miu/ml, this indicates an adequate response.** **The results should be discussed with the reference laboratory.**
100miu/ml or greater	Adequate response.

**check anti-HBc and HBsAg to exclude past infection or chronic carriage before repeating 2nd course of vaccination*

***For those at high occupational risk of contracting hepatitis B, efforts should be made to achieve a response of greater than 100 miu/ml*

In practice 10-15% of those vaccinated fail to respond to hepatitis B vaccines. Natural immunity explains only a very small percentage of this group (around 1% in some studies) but should be excluded as a reason for

non-response. Features predictive of poor response include increasing age, male sex, increased body mass index, smokers and those with immunodeficiency or individuals on immunosuppressive therapy. Non-responders at risk of occupational exposure need to report promptly any inoculation injury, as passive prophylaxis with specific immunoglobulin is required in these cases.

Booster doses

To date there are no data to support the need for booster doses of hepatitis B vaccine in immunocompetent individuals who have responded to a primary course.

Dose and route of administration

The basic schedule consists of three doses of vaccine at day one, one month and six months. The vaccine is given intramuscularly in the deltoid region. In the case of infants the vaccine may be given in the anterolateral thigh. The gluteal region should not be used as the vaccine efficacy may be reduced at this site. Exceptionally, the vaccine may be administered subcutaneously in patients with thrombocytopenia or to persons at risk of haemorrhage.

Larger vaccine doses and/or an increased number of doses may be required to induce protective anti-HBs concentrations in adult haemodialysis patients and other immunosuppressed adults.

Combination preparations

Hepatitis B vaccine is authorised as a tetravalent preparation in combination with for use in infants (Infanrix HepB) for use at two, four and six months of age. It is also authorised as a combination vaccine with hepatitis A vaccine for both adults and children as Twinrix (see chapter 10).

Dosage

Currently licensed products contain different concentrations of antigen per ml.

<u>Engerix B</u>
Age 0-12 years: 10mcg (0.5ml)
Adults: 20 mcg (1.0ml)
Adult haemodialysis patients: 40 mcg (2.0ml)

<u>HB-Vax II</u>
Age 0-10 years: 5mcg (0.5ml)
Adults: 10mcg (1.0ml)

Hepacare is a triple antigen hepatitis B vaccine. It is licensed for active immunisation against Hepatitis B virus infection in non-immune adults (>18 years). The vaccine should be administered intramuscularly. The standard course of vaccination in healthy adults with normal immune responses is two doses given with a one-month interval.

In adults with potentially sub-optimal immune response (such as older adults (>40 years), the obese (BMI>30) and smokers) a third dose is recommended and the vaccine is administered at the elected date, one month and six months. Once initiated the primary course of vaccination must be completed with Hepacare.

For urgent protection (eg. after accidental exposure to blood): Three doses of vaccine should be given at monthly intervals if the individual has not previously been vaccinated. A booster dose is recommended at 12 months. An accelerated schedule for urgent protection is used for travellers to high risk areas, post exposure protection and may also be used to prevent neonatal transmission of hepatitis B from hepatitis B carrier mothers.

Contraindications

A previous serious reaction to a dose of this vaccine.

Precaution

Acute febrile illness is a reason for deferral of vaccination. The response may be impaired in those who are immunocompromised, and a further dose of vaccine may be necessary.

Hepatitis B vaccine in pregnancy

Hepatitis B infection in pregnant women may result in severe disease in the mother and chronic infection of the newborn. Immunisation should not be withheld from a pregnant woman if she is in a high-risk category.

Adverse reactions

Local: Hepatitis B vaccine is generally well tolerated. The commonest reactions are soreness and redness at the injection site.

General: Fever, rash, malaise and influenza-like symptoms are less common reactions.

Post-exposure prophylaxis

Specific hepatitis B immunoglobulin (HBIG) is available for passive protection and is normally used in combination with hepatitis B vaccine to confer passive/active immunity after exposure. At present only one HBIG preparation is authorised in Ireland and this is an intravenous preparation, (Hepatect).

HBIG is recommended for the following groups:

1. Babies born to mothers who are HBsAg positive or who have had acute hepatitis during pregnancy should receive active immunisation and HBIG.
2. All preterm infants born to HBsAg positive mothers should receive immunoprophylaxis (HBIG and vaccine) beginning as soon as possible after birth followed by appropriate post immunisation testing.
3. Health care workers or others accidentally exposed to the blood or body fluids of a HBsAg positive individual unless they have adequate antibody levels.
4. Sexual exposure to an HBsAg positive person.
5. Household exposure of an infant less than 12 months of age to a primary care giver who has acute hepatitis B.

Hepatitis B immunisation in pregnancy and the newborn

The committee recommends routine screening of **all** antenatal patients. If an antenatal patient is HBsAg negative but is at risk of HBV infection, she may be immunised during pregnancy and the immunisation repeated one and six months after delivery. Also pregnant women who are HBsAg negative and at risk of HBV should, if possible, be screened again during the final trimester.

If the mother is HBsAg positive, the infant requires protection at birth as follows:

1. Hyperimmune globulin (HBIG) must be given as soon as possible after birth.
2. Hepatitis B vaccine should be administered concurrently in the anterolateral thigh, (in a different limb from the immunoglobulin if the IM preparation is used). It should be given at birth, one month and at six months.
3. Infants should be tested at eight months of age to determine the outcome of prophylaxis.

Exposure to HBsAg Positive Blood *(Percutaneous or Permucosal eg. trauma from needle stabs and human bites)*.

Individuals who sustain such injuries should wash the affected area well with soap and warm water and seek medical advice. The decision to vaccinate and/or give HBIG prophylaxis depends on the HBsAg status of the person who was the source of the exposure and the hepatitis B vaccination and response status of the exposed person. Urgent clinical and laboratory assessment should be arranged if possible of the person who was the source of the exposure and if necessary of the exposed person. The appropriate prophylaxis should be commenced immediately according to table 6.1. A significant exposure is one from which HBV transmission may result:

- Percutaneous exposure (needlestick or other contaminated sharp object injury, a bite which causes bleeding or other visible skin puncture)
- Mucocutaneous exposure to blood (contamination of non-intact skin, conjunctiva or mucous membrane)
- Sexual exposure (unprotected sexual intercourse).

HBIG (Hepatect) is available in 2 ml ampoules containing 100 iu and 10 ml ampoules containing 500 iu.

HBIG if required should be given within 48 hours of exposure but not later than a week after exposure (a single dose of 6 I.U. to 10 I.U. or 0.12 mls to 0.20 mls per kg for adults). The accelerated schedule of hepatitis B vaccine may still be considered if more than one week has elapsed since exposure.

After sexual exposure to a person with acute hepatitis B infection, a single dose of HBIG (6 I.U. to 10 I.U. per kg) is recommended if it can be given within seven days of the last sexual exposure. For all exposed sexual contacts of persons with acute HBV infection and HBV carriers, hepatitis B vaccine should be administered.

HBIG and hepatitis B vaccine is recommended for infants under the age of 12 months of age if the mother or primary care giver has acute HBV infection. Prophylaxis with HBIG is not indicated for other unimmunised household contacts of persons with acute HBV infection unless they have identifiable blood exposure to the index patient, such as by sharing of toothbrushes or razors. Such exposures should be managed as in sexual exposures. All household contacts of acute cases and carriers should be screened and offered hepatitis B vaccine if susceptible.

Table 6.2 Recommended doses of HBIG for prophylaxis

Injuries from discarded needles in the community

Injuries from discarded needles and syringes in public places create considerable anxiety regarding the possible transmission of blood-borne pathogens. While these injuries pose less of a risk than that resulting from a needle stick injury in health care settings, the perception of risk often results in the necessity for evaluation, testing and counselling of the injured person. Management of such injuries includes acute wound care and consideration of the need for prophylactic management. Tetanus prophylaxis and tetanus immunoglobulin may be administered according to the vaccination status of the injured person provided that they are not receiving post exposure prophylaxis.

Hepatitis B virus is the hardiest of the major blood-borne pathogens as it survives on fomites for several days. A course of hepatitis B vaccine for those who have not been previously immunised will usually be appropriate. HBIG is not usually required unless the needle comes from a known hepatitis B positive source. The likelihood of transmission of other blood-borne viruses such as hepatitis C or HIV is very remote. A possible course of action is to store a baseline serum specimen from the injured person, initiate hepatitis B vaccination and test a repeat specimen taken six months later for hepatitis B, hepatitis C and HIV. In unusual circumstances, where direct inoculation occurs in the community setting with a needle that has been in a person known to be infected with HIV, the prophylactic use of antiretroviral therapy might be considered. All such cases should be immediately discussed with a consultant in infectious disease or other appropriate infectious disease service.

Table 6.3 Hepatitis B vaccine prophylaxis for reported exposure incidents

(1) If the patient source is not known, individual assessment of each case should be made. The benefits of Hepatitis B immunoglobulin should be weighed against assessed risk.
(2) HB (Hepatitis B) vaccine. An accelerated course of vaccine consists of doses spaced at 0,1 and 2 months. A booster dose is given at 12 months to those at continuing risk of exposure to HBV.
(3) HBIG (Hepatitis B immunoglobulin) should be given preferably within 48 hours and not later than a week after exposure.

- Reproduced with permission from UK Immunisation against Infectious Disease 1996

Introduction

Influenza is an acute illness of the upper and/or lower respiratory tracts. It is usually self-limiting with recovery in two to seven days, but it can be severe. It affects all age groups and is characterised by the abrupt onset of symptoms such as headache, fever, myalgia, cough, sore throat and malaise.

Influenza outbreaks result in significant morbidity in the general population. In those with chronic underlying disease, especially the elderly, complications are common and hospitalisation rates high. The elderly contribute up to 80 to 90% of reported deaths from influenza. These arise mainly from bacterial pneumonia, but also from the underlying disease. Fatal influenza A pneumonia is characterised by the abrupt onset of a rapidly progressive diffuse pneumonia with pulmonary haemorrhage. The frequency of overt pulmonary involvement in influenza A infection is age dependent, ranging from 4% in those 10 – 39 years of age to 36% in those aged 60 – 69 years and to 73% in those 70 years of age or older.

Epidemiology

Influenza is highly infectious, spreading rapidly especially in institutions. Two types of single-stranded RNA viruses are responsible for most clinical illnesses, influenza A and influenza B. Influenza A viruses are antigenically labile. They regularly undergo two kinds of antigenic mutation due to changes in the principal surface antigens, haemagluttinin (H) and neuraminidase (N). Minor changes, due to point mutations in the haemagluttinin, termed “antigenic drift” are seen progressively from season to season. Major changes, termed “antigenic shift” occur periodically and can result in the introduction of virtually ‘new’ viruses into a population. Once present these new viruses disseminate extremely rapidly. Thus, antigenic shift with the emergence of new virus strains can give rise to influenza pandemics. Such mutations only rarely occur in influenza B.

Antigenic variation results in the circulation of viruses to which a given population may have little resistance accounting for the high attack rates commonly seen in influenza outbreaks.

Influenza outbreaks occur virtually every year, although the extent and

severity of the outbreaks vary widely. Localised outbreaks occur at variable intervals, usually once every one to three years. Global epidemics or pandemics have occurred approximately every ten to 15 years since the 1918 – 1919 pandemic. The most extensive and severe outbreaks are caused by influenza A viruses. In part, this is the result of the remarkable ability of influenza A viruses to undergo periodic antigenic variation. In some outbreaks, influenza B viruses circulate simultaneously with influenza A viruses. Although pandemics provide the most dramatic evidence of the impact of influenza, overall, outbreaks that occur between pandemics account for greater mortality and morbidity although over a longer period of time. Since 1977, influenza A (H1N1) viruses, influenza A (H3N2) and influnza B viruses have been in circulation.

Influenza A epidemics begin abruptly, reach a peak over a two to three week period, generally last for two to three months and often subside as rapidly as they began. Epidemics begin almost exclusively during the winter months. All of the factors that result in epidemics of influenza are not fully understood. A major determinant of the extent and severity of an outbreak is the level of immunity in the population.

Influenza is spread from person to person by direct contact, by droplet infection or by contact with materials recently contaminated by nasopharyngeal secretions. Airborne spread can also occur. It is highly contagious especially among institutionalised populations. Virus can be detected in respiratory secretions from just before the onset of clinical illness to four to five days after symptom onset. Shedding can be more prolonged in young children.

Influenza vaccine

The major public health measure to prevent influenza has been the use of inactivated influenza vaccines. The vaccine is prepared each year using virus strains similar to those considered most likely to be circulating in the forthcoming season. The virus is egg-grown, inactivated with formalin, and ‘split-virus’ or subvirion, preparations made using solvents or detergents. ‘Surface antigen’ vaccines containing highly purified preparations of viral neuraminidase and haemagglutinin antigens are also available. These three preparations; whole-virus, split-virus (subvirion), and surface-antigen, are of equivalent efficacy but the latter two are less likely to induce febrile reactions in children. Current vaccines are trivalent containing antigens from two type A and one type B virus strains. All are supplied in a prefilled syringe. Vaccines available in Ireland may vary from year to year. The following are licensed for use in Ireland:

Table 7.1 Influenza vaccines

Currently available influenza vaccines can be expected to provide 70 - 90% protection against influenza in populations under 65 years of age. Protective efficacy against infection can be somewhat lower in the elderly however vaccination remains highly efficacious against influenza associated morbidity and mortality in the elderly. Protection lasts about one year. Annual vaccination with the most recent strains is recommended.

The vaccines should be stored at 2 - 8°C and protected from light. They must not be frozen. They should be allowed to reach room temperature and shaken well before they are given.

Future developments

Current influenza vaccines are not ideal. At best efficacy is 70 - 90% and can be reduced significantly when there is an unanticipated antigenic change with introduction of new influenza variants into the population. Furthermore, the need for yearly immunisation remains a significant obstacle to maintaining immunity. Recent studies have shown that live attenuated cold-adapted recombinant influenza virus vaccines administered intranasally are safe and immunogenic in young children. It is anticipated that such vaccines will be easier to administer, more acceptable,

and may, through the induction of mucosal immunity, be more immunogenic and thus have greater efficacy.

Immunisation strategy:

Vaccination is recommended for two groups of individuals:

- Any individual older than six months of age who is at increased risk of influenza related complications
- Those at increased risk of transmitting influenza to a person at high risk for influenza complications.

Vaccination is therefore strongly recommended for adults and children with any of the following:

- Chronic illness requiring regular medical follow-up (e.g. chronic respiratory disease, inc. cystic fibrosis, moderate or severe asthma, chronic heart disease, diabetes mellitus, etc.)
- Immunosuppression due to disease or treatment, including asplenia or splenic dysfunction
- Persons aged 65 years or older
- Children and teenagers on long term aspirin therapy (because of risk of Reyes Syndrome)
- Vaccination is also recommended for residents of nursing homes, old peoples' homes, and other long stay facilities where rapid spread is likely to follow introduction of infection.

Influenza vaccination should also be considered for

Health Care Workers, for the protection of their patients (see Chapter 18) and for their own protection, as they are likely to come in contact with influenza during outbreaks.

Vaccination should not be withheld from high risk pregnant women.

Limited studies suggest that pregnancy may increase the risk of complications from influenza because of the alterations in heart rate, lung capacity, and immunologic function. It is estimated that immunisation could prevent one to two hospitalisations per 1000 pregnant women. Because influenza virus vaccine is not a live vaccine it is considered very safe in pregnancy. To avoid coincidental association with spontaneous early pregnancy loss, administration during the first trimester is generally avoided.

Dose and route of administration of influenza vaccine

As dose recommendations for children can vary between products please consult the individual data sheets.

Table 7.2 Dose and route of administration of influenza vaccine

- The deltoid muscle is the recommended site for adults and older children.
- The anterolateral thigh may be used for infants and young children.
- Antibody levels take from ten to 14 days to rise.
- The ideal time for immunisation is before the influenza season i.e., from September to October.
- Influenza vaccine may be given at the same time, but at a different site, as pneumococcal vaccine. (Note: pneumococcal vaccine is usually given once only).

Contraindications

The vaccine should not be given to persons with known anaphylactic hypersensitivity to eggs.

Precautions

Acute febrile illness.

Minor illness with or without fever is not a contraindication, particularly among children with upper respiratory tract infections.

Adverse reactions

Local

Soreness and redness around the vaccination site occurs in up to one-third of recipients.

General

Fever, malaise and myalgia commencing six to 12 hours after immunisation and lasting for about 48 hours, occur rarely.

Immediate reactions such as urticaria, angio-oedema, bronchospasm, and anaphylaxis occur rarely. Such reactions are most likely due to hypersensitivity to the egg protein.

Influenza vaccine contains inactivated virus and therefore cannot cause influenza.

Antiviral agents

Antivirals such as neuramiadase inhibitors can be used for treatment and prophylactic purposes during influenza epidemics. People who may be considered for prophylaxis include:

- Unimmunised patients in the ‘at risk’ groups for two weeks while the vaccine takes effect
- ‘At risk’ patients , who are hypersensitive to egg, for the duration of an outbreak
- Health care workers and other key personnel to prevent disruption of services during and epidemic. It should be given only for the two weeks while waiting for the vaccine to take effect
- Antiviral agents are not a substitute for vaccination for the control and prevention of influenza.

Introduction

Measles is an acute viral illness characterised by rhinitis, conjunctivitis, an erythematous rash which first appears behind the ears and a pyrexia. The incubation period is about ten days with a further two to four days before the rash appears. Patients are infective from five days before to four days after the onset of rash. Transmission of measles is by droplet infection.

An immunity rate of at least 90% is required to eliminate measles which is highly infectious. Assuming vaccine efficacy of 95%, a minimum vaccine coverage of 95% is needed to achieve this.

Epidemiology

The incidence of measles has declined dramatically since the introduction of measles vaccine in 1985. The number of reported cases fell from a peak of almost 10,000 cases in 1985 to 201 cases in 1987. However, a major resurgence of measles occurred in 1993, when over 4,000 cases of the disease were notified. In 1999 – 2000, over 1,600 cases of measles were reported, with three associated deaths. Incomplete vaccine coverage together with a pool of susceptible unvaccinated older children resulted in rapid spread of the infection.

Effects of measles

Infection with measles causes an acute illness characterised by pyrexia over 38.5° C, cough, rhinitis, conjunctivitis, erythematous rash and Koplik's spots.

Complications of measles include pneumonia, otitis media and encephalitis. Serious complications have been reported in one in 15 cases. Encephalitis (incidence 1 : 5000 cases) has a mortality of about 15% and results in residual neurological sequelae in 20-40% of survivors. Subacute sclerosing panencephalitis (SSPE) is a very rare but fatal complication.

Measles/Mumps/Rubella (MMR) Vaccine

MMR vaccine has been demonstrated to be very safe and effective. It is a freeze-dried live vaccine which is very labile. It must be kept refrigerated at 2-8° C, but not frozen, and it must be protected from light. It should be used

within one hour of being reconstituted with the diluent provided by the manufacturer. Failure to adhere to these recommendations can result in loss of vaccine potency and diminished effectiveness. Immunisation results in seroconversion to all three viruses in over 90% of recipients where the vaccine is appropriately handled and administered. Vaccine induced antibody to rubella has been shown to persist for at least 16 years. It is probable, however, that immunity is lifelong.

Measles infection or vaccination can inhibit the response to the tuberculin skin test. Persons who are tuberculin positive may have a negative tuberculin test for three months after measles infection or MMR vaccine.

Dose and route of administration

The dose is 0.5 ml by deep subcutaneous or intramuscular injection. The deltoid is the recommended site of administration. The anterolateral thigh may also be used.

Alcohol swabs are best avoided as alcohol can inactivate the MMR vaccine. If alcohol is used to clean the skin it must be allowed to evaporate completely before the injection is given.

When other injectible vaccines are being given concurrently with MMR, they should be injected at different sites.

Indications

1. All children at 15 months of age, with a second dose at 4-5 years of age. For those who have not already received two doses, MMR vaccine should be repeated in primary school. A catch-up campaign could be considered to achieve this.

   Note that MMR vaccine can be given to children who have already been immunised with single antigen measles vaccine and to those who have a history of measles, mumps or rubella infection.

2. Measles outbreaks
   Outbreaks of measles should be controlled by immunising all susceptible individuals within 72 hours of contact. During an outbreak, particularly if there are high attack rates in younger infants, MMR vaccine may be given to children as young as six months of age. Children vaccinated before their first birthday should have a repeat vaccination at 15 months of age and a further dose at 4-5 years.

3. Health Care Workers (HCWs) in the following situations:

   i. Those born after 1978 who have not got evidence either of measles infection or of having received two doses of MMR vaccine should be given two doses of MMR, separated by at least one month.

   ii. If an outbreak occurs in an institution or an area served by an institution, HCWs should be given one dose of MMR unless they satisfy the criteria in (i) above.

Contraindications

1. Untreated malignant disease and immunodeficiency states other than HIV infection.
2. Immunosuppressive therapy, high-dose x-ray therapy and current high-dose systemic corticosteroids. (See Chapter 2).
3. A history of anaphylaxis to a previous dose of MMR or one of its constituents (e.g. Neomycin, Gelatin).
4. Pregnancy. Furthermore, pregnancy should be avoided for two months after MMR immunisation.

Allergy to egg, even anaphylaxis, is NOT a contradiction to MMR vaccine. If there is a genuine concern regarding serious allergy, a paediatrician may be consulted and the vaccine given in hospital. Currently used measles and mumps vaccines do not contain significant amounts of egg cross-reacting proteins. Most immediate hypersensitivity reactions to MMR appear to be reactions to other vaccine components (gelatin or neomycin).

Precautions

1. Moderate/serious illness. Immunisation should be carried out as soon as possible after recovery.
2. Injection with another live vaccine within the previous three weeks.
3. Injection of immunoglobulin, whole blood or any antibody-containing blood product within the previous three months. If high doses of immunoglobulin have been administered, vaccine efficacy may be impaired for considerably longer.
4. Patients who developed thrombocytopenia within six weeks of their first dose of MMR should undergo serological testing to decide whether a second dose is necessary. The second dose is recommended where the patient is not fully immune.

Adverse reactions

Local soreness and erythema can occur at the injection site. General fever, headache, vomiting and lymphadenopathy can occur. Rarely, anaphylactoid reactions, erythema multiforme, thrombocytopaenia and nerve deafness have been reported. “Mini measles” may occur six to 10 days after the immunisation and consists of mild pyrexia and an erythematous rash. This is usually quite mild, but sometimes the fever can precipitate a convulsion. “Mini-mumps” with salivary gland swelling may also occur during the third week after immunisation. Cases of aseptic meningitis and encephalitis have very rarely been reported.

The rubella component may occasionally produce mild arthralgia, particularly in post-pubertal females (up to 25% of recipients). The incidence is lower than after natural disease. Surveillance studies have shown no evidence of congenital rubella syndrome or increase in other teratogenic effects in women inadvertently given rubella vaccine before or during early pregnancy, but pregnancy remains a contraindication.

Introduction

Meningococcal meningitis and septicaemia are systemic infections caused by *Neisseria meningitidis. N. meningitidis* is a Gram negative diplococcus which is divided into antigenically distinct serogroups, the commonest of which are B, C, A, Y and W135. In Ireland Group B and Group C strains account for over 99% of all invasive disease whilst Groups X, Y, Z and W135 are occasionally found. Group A has been associated with epidemics elsewhere in the world, particularly in sub-Saharan Africa, Nepal, Mecca and areas of New Delhi but are rarely found in this country. There has been a recent problem (2000/2001) in several countries with Group W135 infection in pilgrims returning from the Hajj. Group C meningococcal conjugate vaccine (MenC) was added to the infant immunisation schedule in the Republic of Ireland in October 2000.

Epidemiology

N. meningitidis is a human-only pathogen and is carried in the nasopharynx. It is spread by respiratory droplets, which are most efficiently generated by coughing, sneezing and mouth kissing. Carriage is typically followed by the development of immunity. A small minority of carriers develop invasive infection after an incubation period which is typically 2-3 days. Overall approximately 10% of the population are carrying *N. meningitidis* strains. Carriage is uncommon in infancy and early childhood and carriage rates increase with age. Peak carriage rates occur in the 15-19 year old group of whom up to 25% may be carriers. Colonisation is typically asymptomatic and provides the focus from which the organisms are spread.

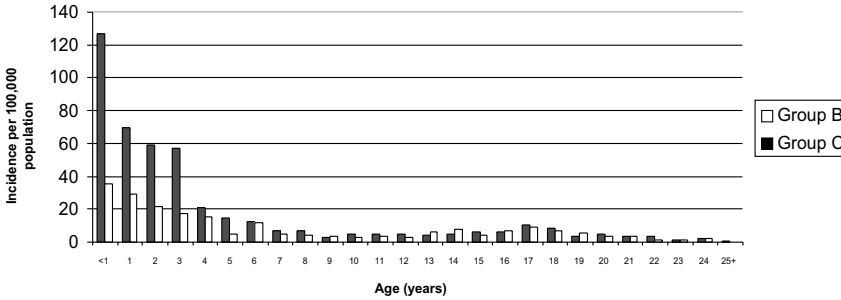
Invasive meningococcal infection is endemic in all Northern European countries with a background incidence of two to three culture confirmed cases per 100,000. In temperate climates such as Ireland the infection typically shows a seasonal variation with the majority of cases occurring in winter and early spring. The disease season therefore is considered to span the “epidemiological years” from July 1st to Jun 30th. Periodic upsurges in meningococcal activity occur associated with increased circulation of several distinct subtypes resulting in hyperendemic disease. At present Ireland is experiencing hyperendemic meningococcal disease with a culture confirmed invasive infection rate of 4.85 per 100,000 in 2000/2001.

Hyperendemic meningococcal infection is also a feature in other countries at this time including the Netherlands and Iceland. Such hyperendemic infection is distinct from epidemic infection with a single strain as has been seen with Group A in sub-Saharan Africa and with Group W135 in Hajj pilgrims in recent years. Hyperendemic and epidemic infection with a single Group B strain has also been a problem in New Zealand.

The introduction of non-culture methods of diagnosis (detection of specific nucleic acid, and acute and convalescent phase serology) has led to the diagnosis of and confirmation of meningococcal infection in increased numbers of cases. In Ireland in 1999/2000 the culture confirmed incidence was 4.8 cases per 100,000. Non culture methods increased the rate to 12.38 per 100,000 which more closely approaches notification rates.

Invasive meningococcal disease may occur at any age but is most common in infancy and early childhood with an additional smaller peak of disease activity in adolescents and young adults (Figure 9.1). Group C infection is typically associated with higher morbidity and mortality rates in adolescents and young adults than in other age groups. The percentage mortality from meningococcal disease was 5% overall in the period January 1997 to June 2000. Although Group B and Group C mortality were similar overall, the percentage mortality from Group C in 15-19 years olds was 12%.

Figure 9.1 Average annual incidence of definite (culture +/or PCR positive) Group B and Group C invasive meningococcal disease, July 1997 - June 2000



Impact of Group C vaccine

MenC vaccine was introduced in October 2000 into the infant schedule in the first year of life, and offered in a catch-up programme to all up to and including 22 years. Since the introduction of the vaccine, the incidence of Group C meningococcol disease has shown a dramatic reduction.

The number of notifications of all meningococcal disease and of Group B and Group C meningococcal disease in Ireland between 1997 and 2001 are shown below. A dramatic reduction in the number of notified cases of meningococcal disease caused by Group C organisms can be seen.

Table 9.1 Notified cases of group B and C meningococcal disease, 1997-2001

Statistical analysis of the numbers of cases of definite (culture +/or PCR positive) meningococcal disease due to Group B, C and other types, for the time period October – June in each of the last 2 epidemiological years shows a highly significant drop in number of Group C cases.

Table 9.2 Definite cases of meningococcal disease Oct 1999/ Jun 2000 to Oct 2000/ June 2001

Fisher Exact Test (2 tail) P = <0.00000005

Effects of meningococcal disease

The onset of disease may be fulminant with abrupt onset of fever, prostration, shock, a progressive purpuric rash and death, or it may be insidious following a mild upper respiratory prodrome of 2 or 3 days. In an infant or young child the common early symptoms - reluctance to feed, trivial fever and irritability- are non-specific and are seen with other common childhood infections. The child's skin may appear blotchy or pale. A typical non-blanching rash is frequently present in patients with meningococcal septicaemia. This rash may appear as petechiae, palpable purpuric lesions that may coalesce, or bruise-like blotches. The rash may be very scanty and initially may be non-specific consisting of blanching erythematous lesions. Patients may present in coma. With the exception of the rash, which is present in some 40% of patients with meningococcal meningitis, the signs of meningococcal meningitis are indistinguishable from those of bacterial meningitis caused by other pathogens.

Initial treatment

a. Primary Care

In view of the high mortality rate from meningococcal infection and the often rapid deterioration of the patient prior to hospital admission, early treatment of suspected cases of the condition with benzylpenicillin may be life saving. It is recommended that GPs carry supplies of this drug in an emergency bag.

Recommended Dosage of Benzylpenicillin

Adults and children > 10 years	1200 mgs
Children 1-9 years	600 mgs
Children <1 year	300 mgs

This, ideally, should be given intravenously. It can be given by the intramuscular route in shocked patients but is not as effective.

If there is a history of penicillin anaphylaxis (which is extremely rare, of the order of 0.002% of exposed patients), chloramphenicol may be given by injection in a dosage of 1.2 g for adults and 25 mg/kg for children under 12 years.

b. Hospital Care

The Committee recommends that each acute hospital have guidelines in place for the acute management of suspected invasive meningococcal disease. Template guidelines for the management of suspected meningococcal sepsis and meningitis were prepared in 1998 by a subcommittee of the RCPI, and the Department of Health and Children have circulated these guidelines, and subsequent modifications, to all acute hospitals.

Chemoprophylaxis

Chemoprophylaxis should be given to close contacts of confirmed or suspected cases of meningococcal disease as soon after notification of the index case of possible.

People who are **close contacts** of a case of meningococcal disease are at higher risk of developing disease than people who are not contacts. This risk is highest in the first seven days after a case and falls during the following weeks. The rationale for chemoprophylaxis is that it is given to eliminate carriage of the organism from the network of close contacts of the case and thereby reduce the subsequent spread of the organism to other

susceptible persons. It also aims to eliminate carriage from recently colonised susceptibles in the period before invasive disease may develop.

1. Prophylaxis for the index case must be initiated prior to discharge from hospital and ideally should be given as soon as the patient can tolerate oral medication. Prophylaxis is not necessary if the index case was treated with cefotaxime.

2. Close contacts are defined as those who in seven days prior to the onset of illness of the index case
   - shared living or sleeping accommodation with the patient; this includes baby-sitters/baby minders
   - had mouth kissing contact with the patient; this does not include cheek kissing
   - were in the same nursery/creche as the patient, where the nature of nursery/creche contact is similar to that for household contacts. This includes adult carers.

3. The absolute risk in Health Care Worker contacts of developing meningococcal infection is small ($0.8/10^5$). Nonetheless, there is a slightly increased risk from unprotected airway exposure to nasopharyngeal secretions of patients within the first 24 hours of treatment.

   Chemoprophylaxis is thus recommended only for those HCWs whose mouth or nose is directly exposed to infectious respiratory droplets or secretions within one metre of a probable or confirmed case of meningococcal disease, within 24 hours of the commencement of antibiotics.

   Chemoprophylaxis is not recommended without a clear history of such exposure.

   HCWs should be encouraged to wear particulate filter masks when carrying out high-risk procedures.

   Pathologists and pathology technicians who may be exposed to infected airborne droplets during the performance of an autopsy should receive chemoprophylaxis, when a mask has not been worn and when the deceased child did not receive appropriate systemic antibiotics for a minimum of 24 hours antemortem.

4. Chemoprophylaxis is not considered necessary for classmates and teachers of an index case unless there are more cases of infection with the same strain in the school during the same term. However the opportunity should be used in all cases to give advice to all parents and guardians of pupils attending the school on the signs and symptoms of the disease, as soon as practically possible.
    - If two or more cases of infection with the same strain occur in the same class all class members and staff should receive prophylaxis
    - If the cases occur in different classes, management is more difficult but should be guided by such considerations as
        - the interval between the cases
        - the size of the contact group
        - the carriage rate in the school
        - whether the cases are due to a vaccine preventable strain
        - the degree of public concern particularly if a death has occurred
        - the incidence of the disease in the wider community.

    In such situations management should be discussed with the Specialist in Public Health Medicine with responsibility for Infectious Disease control, the Infectious Disease Consultant or the Microbiologist in the hospital dealing with the case.

5. It is not recommended that prophylaxis be given routinely to passengers on public transport, e.g. bus, train, where an index case has been identified.

6. Special consideration should be given to the attendance of an index case at a house party in the preceding seven days especially if pre-school children were present. If chemoprophylaxis is appropriate it should be given to all attenders, both adult and children.

7. Special consideration should be given to situations in which there is greater than usual interaction between members of the extended family and an index case, particularly where over crowding or adverse environmental living conditions exist.

8. Ideally chemoprophylaxis should be given to all contacts as soon as possible after notification of the index case. However it is appropriate to administer chemoprophylaxis to close contacts, who may not have come to notice initially, up to a month after identification of an index case, as carriage may persist for a long period.

Choice of prophylactic antibiotics

- Rifampicin is the drug of choice
- Rifampicin should be given promptly and preferably within 24 hours of diagnosis of the index case.

All close contacts should be advised that infection may occur even if prophylaxis is given. This is because the antibiotic may not be effective if the contact is incubating disease, or because the contact may become recolonised and then develop the disease.

Dose of rifampicin

Children 0 - 1 month	5 mg/kg twice daily for two days
Children 1 month - 12 years	10 mg/kg twice daily for two days
Children over 12 yrs & Adults	600 mg twice daily for two days

Side Effects

Rifampicin recipients should be warned about these. They are

- interference with contraceptive pill
- interference with anticoagulants
- red coloration of urine, sweat and tears
- permanent discolouration of soft contact lenses

Contraindications to rifampicin: severe liver disease and pregnancy.

Alternative prophylaxis: ceftriaxone as a single dose (250mg in adults, 125mg in children under 12 years) - see data sheet. Although not licensed for this purpose a single dose of Ciprofloxacin 500mg orally for adults has been shown to be effective.

Pregnancy: Close contacts who are known to be pregnant should consult their obstetrician. Options following counselling include giving no prophylaxis, giving ceftriaxone, or taking a throat swab and giving prophylaxis if meningococcus is cultured. While no drug can be regarded as absolutely safe in pregnancy harmful effects on the foetus have not been documented in relation to use of this drug.

Meningococcal Vaccine

Plain polysaccharide (PS) meningococcal vaccine

The licensed meningococcal PS vaccine (Mengivac A+C) is effective against serogroup A and C organisms. A group specific serological response to PS vaccine is detected in more than 90% of recipients and occurs five to seven days after a single injection. However, young children respond less well than adults with little response to the Group C polysaccharide below 18 months and limited response from 18-24 months and little response to Group A polysaccharide below three months. Because of the poor or absent immunogenicity in the group at highest risk (children under two years) and the relatively short duration of induced immunity in childhood, plain PS vaccine is unsuitable for use in a general immunisation programme.

Dose and route of administration

A single dose of 0.5 ml is given by deep subcutaneous or intramuscular injection to adults and children of two months of age.

Indications

In the case of Group C, the conjugate vaccine has largely superceded the plain PS vaccine. Where stocks of MenC are limited, the PS vaccine may be used for immunisation of non-immunised contacts of cases of Group C disease. Immunisation with the A/C PS is also recommended for travel to areas where epidemics with Group A and Group C infection occur.

Contraindications

1. Acute febrile illness (immunisation should be postponed).
2. Pregnancy. Although there is no information to suggest that meningococcal vaccine is unsafe during pregnancy, it should only be given in exceptional circumstances (i.e. when required to travel to high-incidence regions). During an epidemic of meningococcal meningitis in Brazil, no adverse events were reported following vaccination of pregnant women.
3. Severe reaction to a previous dose.

Adverse reactions

Local: Injection site reactions occur in approximately 10% of recipients and last for approximately 24 - 48 hours.

General: Generalised reactions are rare although pyrexia occurs more frequently in young children than in adults.

Meningococcal C conjugate (MenC) vaccine

The meningococcal C conjugate vaccine was developed using the technology that had been used successfully in development of the Hib vaccine. Conjugation involves attaching a carrier protein to the Group specific polysaccharide antigen. The conjugated vaccine induces a T-cell dependent antibody response and immunological memory, and is immunogenic in children down to two months of age. The MenC vaccine therefore overcomes the limitations of the previously available PS vaccine.

Two MenC vaccines are available in this country. These are “Meningitec” manufactured by Wyeth Lederle and “Menjugate” manufactured by Chiron Pharmaceuticals. Both are available as a suspension.

Dose and route of administration

The dose at all ages is 0.5 ml. A single dose is given by intramuscular or deep subcutaneous injection, to individuals aged one year and over. Infants and babies under 12 months require three doses of at least one month apart. For infants under six months of age, three doses are given at least one month apart, usually at two, four and six months as part of the primary schedule of immunisation. The vaccine is given preferably in the anterolateral thigh in infants, and in the deltoid region in older children, adolescents and adults. MenC vaccine when given concurrently with other vaccines should be administered at a separate site.

In patients with thrombocytopenia or bleeding disorders, MenC vaccine may be given subcutaneously (see Chapter 2)

Indications

Immunisation with MenC conjugate vaccine became part of the routine schedule of infant immunisations in the Republic of Ireland from October 2000. MenC will be given at the same time as primary immunisation with DTaP, Hib, and IPV at two, four and six months. Unvaccinated children aged 12 months and over only need one dose.

A “catch-up” programme of immunisation commenced in October 2000 under which MenC vaccine was offered to everyone up to and including 22 years of age.

Contacts of cases

Close contact of cases of meningococcal infection have a considerably increased risk of developing the disease in subsequent months, despite appropriate chemoprophylaxis. Immediate family or close contacts of cases

should be given chemoprophylaxis with rifampicin. If results of typing indicate a Group C strain, MenC vaccine should be given. MenC vaccine should not be given to contacts of cases of infection with Group B or other Groups.

Local outbreaks

In addition to sporadic cases, outbreaks of meningococcal infection due to Group C organisms tend to occur in schools and military establishments. Immunisation has been shown to be effective in controlling epidemics, reducing infection but not carriage rates. If supplies of MenC vaccine are limited, PS vaccine may be used in this situation.

Meningococcal vaccine has no role in management of outbreaks of Group B meningococcal infection

Adults in high risk groups

Those with functional or anatomic asplenia and those with terminal complement pathway or properdin deficiencies should receive one dose of MenC conjugate vaccine. The need for additional doses in high risk groups has not yet been established and will be kept under review.

Contraindications

1. Pregnancy: Although there is no evidence that MenC vaccine is unsafe during pregnancy, it should not be given unless there is a high risk of the individual developing the disease.
2. Acute febrile illness: Immunisation should be postponed
3. Those who have had a severe systemic reaction to a previous dose of the vaccine or to any constituent of the vaccine including meningococcal C polysaccharide, diphtheria toxoid or the CRM197 carrier protein (contained in both of the currently available MenC vaccines and in Hib vaccine).

A previous local reaction is not a contraindication to vaccination.

Precautions

Acute febrile illness.

Adverse reactions

Local: Injection site reactions may occur, are generally mild and last for approximately 24 - 48 hours.

General: Generalised reactions are rare.

Group B meningococcal vaccines

There are no available vaccines for the Group B strains currently circulating in Ireland. Such vaccines are currently under development.

Quadrivalent vaccine

There is a quadrivalent vaccine which protects against Group A, C, W135 and Y organisms. This vaccine is required for entry to Saudi Arabia during the Hajj pilgrimage. It is currently not licensed in Ireland.

Mumps is an acute viral illness characterised by swelling of one or more of the salivary glands, usually the parotid. Central nervous system involvement is frequent, but symptomatic meningitis occurs in less than 10% of cases. Rarely transverse myelitis, cerebellar ataxia, or encephalitis can occur. Orchitis occurs in approximately 20% of post-pubertal males, but sterility rarely results. Other unusual manifestations include arthritis, carditis, nephritis, pancreatitis, thyroiditis and hearing impairment. Illness is more severe in adults.

Epidemiology

Humans are the only known hosts. Transmission is by direct or droplet spread. Cases are infectious from approximately six days before to ten days after onset of symptoms, though maximum infectivity is from one to two days before to five days after onset of symptoms. The incubation period is from 12-25 days (usually 16-18 days).

Mumps vaccine

This is a live virus vaccine prepared from chick embyro cell culture. It is administered in combination with measles and rubella vaccine as MMR vaccine. Protective antibodies develop in over 95% of children after a single dose.

For **contraindications** and **precautions** see Chapter 2

Introduction

Pertussis (whooping cough) is a highly infectious bacterial disease caused by *Bordetella pertussis*. Most cases occur in children less than one year of age.

Epidemiology

Pertussis occurs endemically with periodic outbreaks. Epidemiological data on pertussis in the Republic of Ireland (RoI) have been gathered annually since 1941. There has been a steady decline in mortality which commenced before the introduction of the vaccine, but the rate of decline has accelerated following its introduction.

Humans are the only known hosts of *B. pertussis*. Transmission occurs by close contact via droplet infection from the respiratory tract of symptomatic individuals. The incubation period is usually seven to ten days and rarely more than two weeks. As many as 90% of non-immune household contacts acquire the infection. Communicability is most likely in the catarrhal stage before the onset of paroxysms of coughing, but may last for up to three weeks. Thereafter the risk diminishes rapidly. Erythromycin therapy, 20-30 mgs/kg 12-hourly (max. 1 gram b.d.) for 14 days decreases infectivity and may limit secondary spread.

Effects of pertussis

The initial catarrhal stage has an insidious onset and this is the most infectious period. An irritating cough gradually becomes paroxysmal, with a characteristic inspiratory whoop and / or vomiting in about 50% of cases. This paroxysmal stage usually occurs within one to two weeks, and often lasts for two to three months. In young infants, the typical “whoop” may never develop and coughing spasms may be followed by periods of apnoea and cyanosis. Pertussis may be complicated by bronchopneumonia, and by cerebral hypoxia with resulting risk of seizures and encephalopathy. These complications and deaths occur most commonly in infants under six months of age.

Pertussis vaccine

Pertussis vaccines contain purified pertussis antigens designed to elicit an

immune response. The concentrations of antigens differ between acellular pertussis vaccines but usually include inactive pertussis toxin, filamentous haemagglutinin and pertactin.

The vaccine should be stored between 2-8°C, but not frozen. If the vaccine has been frozen, it should not be used.

A full course of vaccine confers protection in over 80% of recipients. High vaccine uptake rates are therefore very important in order to reduce the incidence of pertussis. In those not fully protected the disease is usually less severe.

Dose and route of administration

The dose is 0.5 ml given by deep subcutaneous or deep intramuscular injection into the anterolateral thigh or deltoid in older children.

Indications

Acellular pertussis vaccine as a component of the primary course of immunisation against diphtheria, tetanus and pertussis (DTaP) is recommended for all infants from two months of age, unless there is a genuine contraindication (see Chapter 2).

The primary course consists of three doses given at two, four and six months with a booster at four to five years (see immunisation schedule). If the primary course is interrupted it should be resumed but not repeated, allowing appropriate intervals between the remaining doses.

Children who have received a full course of immunisation against diphtheria and tetanus without the pertussis component can be given three doses of monovalent pertussis vaccine at monthly intervals. There is no upper age limit for the vaccine; however it is usually considered unnecessary after the age of seven years.

If pertussis vaccine is contraindicated or refused by parents, then DT should be offered.

Pertussis vaccination should be considered for children aged under ten years who are exposed to pertussis, if they have received less than four doses of the vaccine. Children may be given dose four at as early as twelve months of age, preferably six months after dose three.

Contraindications (see Chapter 2)

Precautions (see table 2 Chapter 2)

1. Moderate to severe illness. Postpone until recovered
2. Temperature of 40.5°C within 48 hours of previous dose of DTP/DTaP for which no other cause was established
3. Hypotonic hypo-responsive episode within 48 hours of a previous dose of DTP/DTaP
4. Seizures within 72 hours of a previous dose of DTP/DTaP
5. Persistent unconsolable crying lasting longer than 3 hours within 48 hours of a previous dose of DTP/DTaP.

HIV positivity

HIV positive individuals may receive pertussis vaccine unless there are specific contraindications.

Adverse reactions

Local: Minor side effects (eg. local redness, swelling) occur in about 15-20% of recipients.

General: Fever and irritability can occur, however temperature over 40°C is rare. Serious side effects such as prolonged inconsolable crying or hypotonic - hyporesponsive episodes are rare and have not been shown to cause long-term problems. Administration of paracetamol 10mg/kg at the time of immunisation, repeated four and eight hours later, may reduce the incidence of local and febrile reactions.

Advice from a child's paediatrician may need to be sought prior to immunisation where there is:

- a personal history of convulsions
- an evolving neurological problem
- if an event listed in the precaution section (chapter 2) has occurred after a previous dose.

Introduction

The pneumococcus is the most common bacterial cause of community acquired pneumonias in children and adults. The causative organism is *Streptococcus pneumoniae*, of which over 90 polysaccharide capsular types are known.

Epidemiology

Pneumococcal infection is a leading cause of death worldwide and mortality is highest in patients who develop bacteraemia or meningitis. Transmission is from person to person by droplet infection. The incubation period varies by type of infection, and can be as short as one to three days.

Effects of pneumococcal disease

S. pneumoniae can cause pneumonia, meningitis, septicaemia, sinusitis and acute otitis media.

Pneumococcal vaccines

At present two vaccines are available in Ireland.

1. Polysaccharide Pneumococcal Vaccine (Pneumovax II, PS23). This incorporates 23 of the most common capsular types. It should be kept refrigerated at 2-8°C. An adequate antibody response does not develop in those under two years of age.
2. A conjugate 7 valent vaccine (Prevenar, PCV7) has recently been licenced for use in at-risk children aged under two years of age. It has enhanced immunogenicity compared with the polysaccharide vaccine, even in infancy. It is active against approximately 70% of isolates causing invasive disease.

Dose and route of administration

1. Polysaccharide Pneumococcal Vaccine - A single dose of 0.5 ml should be given subcutaneously or intramuscularly. The deltoid area or the lateral aspect of the thigh are the preferred sites for injection. The vaccine is not recommended for children under two years of age as it is

poorly immunogenic in this age group.

2. Conjugate Pneumococcal Vaccine - A dose of 0.5 mls should be given by intramuscuscular injection, according to the following schedule:-

Table 12.1 Vaccination schedule for conjugate pneumococcal vaccine

Those who receive the conjugate vaccine should be given the polysaccharide vaccine after the age of two years, at least eight weeks after their last dose of conjugate vaccine.

Both pneumococcal vaccines can be given at the same time as other vaccines, but at a different site.

There is some doubt about the duration of efficacy of the vaccines, particularly in immunocompromised persons. A single revaccination with the polysaccharide vaccine may be employed for those at highest risk of disease after an interval of greater than five years.

Indications

The vaccine is recommended for use in persons who are at increased risk of pneumococcal disease and its complications, particularly those with:

1. Asplenia or severe dysfunction of the spleen, including surgical splenectomy.
2. Chronic renal disease or nephrotic syndrome.
3. Chronic heart, lung or liver disease, including cirrhosis.
4. Diabetes mellitus.
5. Sickle cell disease.
6. Immunodeficiency or immunosuppression due to disease or treatment including HIV infection at all stages.
7. Patients with CSF leaks, either congenital or complicating skull fracture or neurosurgery.

8. The elderly. For logistical considerations 65 years of age is regarded as an appropriate age to implement such a policy.

Contraindications

1. Hypersensitivity to any of the vaccine components.
2. Pregnancy; however in high risk persons immunisation is justified.

Precautions

1. Revaccination within five years of a previous dose of polysaccharide pneumococcal vaccine. However, if the vaccine has been given during chemotherapy or radiotherapy, revaccination three months after treatment is recommended.
2. Acute febrile illness – defer until recovery.

Adverse reactions

Local: Localised tenderness and erythema at the injection site may occur. Intradermal administration may cause a severe local reaction.

General: Occasional low grade fever lasting less than 24 hours.

Reimmunisation with the polysaccharide vaccine has produced severe reactions especially if less than five years have elapsed since the first injection.

Introduction

Poliomyelitis is an acute illness which may result from invasion of the gastro-intestinal tract by one of three types of polio virus (1, 2 and 3). The virus has a high affinity for nervous tissue. Inactivated poliomyelitis vaccine (Salk) was introduced to Ireland in 1957 and replaced by attenuated live oral polio vaccine (Sabin) in the early 1960's. Inactivated polio vaccine has been reintroduced into the primary immunisation schedule in 2001. Individuals born before 1958 may not have been immunised.

Epidemiology

Poliomyelitis is endemic in some developing countries where epidemics of poliomyelitis occur. In countries where the disease incidence is low, but where transmission still exists, polio cases are seen sporadically or as outbreaks among unimmunised individuals. The most recent case of wild poliomyelitis notified in Ireland was in 1984. If current trends continue, and polio is eradicated in the near future there will be no need for polio vaccines.

Transmission is through contact with the faeces or pharyngeal secretions of an infected person. The incubation period ranges from 3-21 days, but may be longer. Cases are most infectious from about ten days before to seven days after the onset of symptoms. However, carriers may shed virus in the faeces for longer than six weeks.

Effects of poliomyelitis

Most infections are clinically inapparent. Clinical disease may range in severity from a non-paralytic fever to aseptic meningitis or paralysis. Symptoms include headache, gastro-intestinal disturbance, malaise and stiffness of the neck and back, with or without paralysis. The proportion of inapparent to paralytic infections may be as high as 1000:1 in children and 75:1 in adults.

At present an active surveillance system for acute flaccid paralysis is in operation in Ireland. This commenced in September 1998. In any case of acute flaccid paralysis, it is essential to obtain two faecal samples 24-48 hours apart for viral culture, as soon as possible after the onset of paralysis.

Poliomyelitis Vaccine

Poliomyelitis vaccine is available in two forms: Inactivated Polio Vaccine (IPV) and live Oral Polio Vaccine (OPV).

Inactivated Polio Vaccine (IPV)

IPV contains polioviruses of all three types which have been inactivated by formaldehyde. The primary course consists of three injections at least one month apart.

Preparations of IPV

(a) DTaP/IPV, with or without Hib and Hep B

(b) IPV alone - This is not licensed, but is available on a named patient basis.

(c) Td/IPV - This is licensed but not readily available.

Recommendations for IPV vaccination.

- All children should receive four doses of IPV at two, four and six months, and four to five years of age.
- The preferred interval between the first three doses is two months. If accelerated protection is needed, the minimum interval between doses is four weeks.
- No additional doses are necessary if more time than recommended elapses between doses.
- Those who started the vaccine series with one or more doses of OPV should receive IPV to complete the series. A minimal interval of four weeks should elapse between OPV and IPV but a gap of at least two months is preferable.
- IPV can be administered simultaneously with all other routinely recommended childhood vaccines. These include DTaP, Hib, all preparations of Meningococcal C and MMR vaccines.

These recommendations may differ from recommendations contained in the manufacturers literature.

Unimmunised adults:-

Three doses are recommended, the second one to two months after the first dose, and the third dose six to twelve months later.

If protection is needed more rapidly, doses can be given at four weekly intervals.

If protection is needed in under four weeks, OPV can be used as one dose of OPV results in enhanced mucosal immunity when compared with one dose of IPV. The course should be completed as recommended above with IPV.

Incompletely immunised adults:-

The course should be completed with IPV, regardless of the interval since the last dose or the type of vaccine previously given. Fully vaccinated adults at increased risk of exposure to wild poliovirus should be given a single dose of IPV. Such persons include :-

1. Those travelling to areas where poliomyelitis is epidemic or endemic.
2. Those in contact with patients who may be excreting wild poliovirus.
3. Those in contact with specimens which may contain wild poliovirus.

Contraindications

A previous anaphylactic reaction to IPV, neomycin or streptomycin.

Precaution

Even though there is no convincing evidence of an increased rate of adverse events, IPV should not be administered to a pregnant female unless the benefits of vaccination outweigh theoretical risks.

Live Oral Polio Vaccine (OPV)

This is no longer routinely recommended as part of the primary vaccine schedule as the risks of vaccine - associated paralytic polio (VAPP) of approximately one case per 2.5 million doses are greater than the risks of wild virus poliomyelitis except in those travelling to areas where polio virus is endemic.

Indications- Unvaccinated persons travelling to areas or countries where polio is endemic or epidemic, and who cannot receive a full course of IPV (see Chapter 19).

In the uncommon event where there is a true contraindication to the pertussis component of the 5 in 1 vaccine then OPV or IPV may be given. In the rare instances where OPV is given to children, then unimmunised contacts should be vaccinated against polio.

Contraindications

1. An anaphylactic reaction to a previous dose of OPV or any of its constituents, including neomycin.

2. Immunodeficiency states (see Chapter 2). Such persons can be given IPV, although a protective response cannot be ensured.

3. Household contacts of those with immunodeficiency disorders should not be given OPV. They can be given IPV.

4. Pregnancy, even though there is no convincing evidence of an increased rate of adverse effects from OPV or IPV in either the pregnant mother or her foetus.

5. HIV positive individuals should only be given IPV.

Precautions

1. Immunisation should be postponed if the recipient has:
   (a) Vomiting or diarrhoea.
   (b) An acute febrile illness with a temperature above 38°C.

2. OPV should be given **not less than** three weeks before or **not less than** three months after an injection of normal immunoglobulin (eg. for hepatitis A). This may not always be possible in the case of travellers going abroad. However, in such cases the OPV is likely to be a booster dose and the possible inhibiting effect of immunoglobulin is less important.

3. OPV may be given at the same time as inactivated vaccines and with other live viral vaccines except oral typhoid vaccine unless time constraints exist. If not given at the same time as other viral vaccines, an interval of three weeks is recommended. When BCG is given to infants, there is no need to delay the primary immunisations including polio vaccine, as the polioviruses of the vaccine replicate in the intestine to induce local immunity and serum antibodies.

4. OPV should not be given within three weeks of oral typhoid vaccine.

Adverse reactions - Allergic reactions occur very rarely. Vaccine-associated poliomyelitis (VAPP) has been reported in one recipient case and one contact case per two million doses of OPV. The greatest risk of paralysis occurs with the first dose of OPV.

To minimise the risks of VAPP in contact of those recently immunised with OPV strict hygiene after changing or toileting should be observed for six weeks after vaccination.

Rubella is a mild disease resulting in slight pyrexia, a generalised erythematous maculo-papular rash and lymphadenopathy involving particularly the cervical region. Arthralgia, which is more common in adolescents and adults, is rare in children. Encephalitis, and thrombocytopenia may rarely occur. Clinical diagnosis of rubella is often inaccurate, and infection may be asymptomatic in 25-50% of cases.

Congenital Rubella Syndrome:

Maternal rubella infection in pregnancy may result in major defects of the foetus. These most commonly involve the heart (patent ductus arteriorsus, atrial or ventricular septal defects, etc.), the eyes (cataracts, glaucoma, retinopathy) the CNS (microcephaly, meningoencephalitis), and the ears (sensory neural deafness). Intrauterine growth retardation, hepatosplenomegaly, thrombocytopenia and purpuric skin lesions may also occur.

Congenital defects occur in over 50% of cases if infection occurs in the first month of pregnancy, in 20-30% if during the second month, and in 5% during the third and fourth months of pregnancy.

Epidemiology

Humans are the only known hosts. Transmission is by direct or droplet spread. Most infections occur in winter or early spring. The incubation period is from 14-23 days, and it is infectious from one week before to one week after onset of the rash. Infants with congenital rubella may shed the virus from their naso-pharynx or in the urine for over one year.

Rubella vaccine

This live virus vaccine is grown on human diploid cells. It is given in combination with measles and mumps vaccine as the MMR vaccine. (For **contraindications** and **precautions** see Chapter 2).

Introduction

Tetanus is an acute neurological disease characterised by muscular rigidity with superimposed contractions. It is caused by the neurotoxin produced by *Clostridium tetani* which grows anaerobically in a contaminated wound. Effective protection against tetanus is provided by active immunisation.

Epidemiology

The organism is ubiquitous. Tetanus spores are present in the soil and may be introduced into the body during injury, often through a puncture wound but also through burns or trivial wounds. Tetanus is not transmissible from person to person.

The incubation period is between four and 21 days, commonly around ten days. Those most at risk of developing tetanus are people over 60 years, many of whom have never had active immunisation. In 1993, one case involving an elderly female was reported in the Republic of Ireland.

Effects of tetanus

The onset of muscle spasms is gradual during the first one to seven days and progresses to severe generalised muscle spasms. These spasms persist for a week or more and subside in a period of weeks in those who recover. Local tetanus is manifested by muscle spasms in areas contiguous to the wound.

Tetanus toxoid

Immunisation protects by stimulating production of antitoxin which provides immunity against the effects of the toxin. A cell-free preparation of toxin is converted into the innocuous tetanus toxoid. This however is a relatively poor immunogen, and for use as a vaccine it is usually adsorbed onto an adjuvant, aluminium phosphate or aluminium hydroxide. *Bordetella pertussis* also acts as an effective adjuvant.

The available antigens for immunisation are:

- Adsorbed diphtheria/tetanus (DT for those under ten years of age, Td for those ten years and over)
- Adsorbed diphtheria/tetanus/pertussis (DTaP).

-DTaP/IPV
-DTaP/IPV/Hib

Toxoids should be stored at 2-8°C.

Dose and Route of Administration

The dose is 0.5 ml given by intramuscular injection into the anterolateral thigh or the deltoid area.

Indications
Immunisation of infants and children under ten years

Primary Immunisation

This consists of three doses (for primary immunisation schedule, see Chapter 2).

Booster Doses

A booster dose should be given at school entry (as DTaP), at least three years after the third primary dose with a further dose between the ages of ten and 14. The aim is that each child should be given five doses of tetanus and diphtheria toxoids.

Td is now recommended as a replacement for tetanus-only boosters for those aged over ten years. For immunised adults who have received five doses of tetanus toxoid, booster doses may be unnecessary as they may cause considerable local reactions.

Immunisation of persons aged ten years or over (unimmunised)

Primary Immunisation

This consists of three doses of tetanus toxoid (as Td) with intervals of at least one month between doses.

Booster Doses

A booster dose of tetanus toxoid (as Td) should be given ten years after the primary course and again ten years later (as Td).

Contraindications (see Chapter 2)

Severe local or general reaction to a preceding dose of toxoid, if it is thought that the tetanus component caused this reaction.

Precautions

Immunisation should be postponed if the intended recipient has an acute febrile illness with a temperature of 38°C or higher, except in the presence of a tetanus prone wound. Minor illnesses with a temperature of less than 38°C are not a reason for postponing vaccination.

HIV positivity

HIV positive individuals can be immunised against tetanus in the absence of contraindications.

Adverse reactions

Local: pain, redness and swelling around the injection site can occur and persist for several days.

General: headache, malaise, myalgia and fever are uncommon. Rash and lymphadenopathy occasionally occur.

Guide to tetanus prophylaxis

Table 15.1: Recommendations regarding tetanus prophylaxis

(1) Such as wounds contaminated with dirt, faeces, soil and saliva; puncture wounds, avulsions, wounds resulting from crushing, burns, frostbite, missiles.

(2) Consider TIG if wound contaminated with stable manure.
Give TIG if HIV positive, irrespective of vaccine status.

(3) Use DTaP if < ten years.
DT if pertussis vaccine contraindicated.
Use Td if over ten years of age.

Specific Antitetanus Immunoglobulin

Indications

1. Those with tetanus prone wounds who have not received at least three doses of tetanus toxoid in the previous ten years (see table above).
2. Patients with impaired immunity (see Chapter 2) who suffer a tetanus-prone wound may not respond to toxoid and may in addition require antitetanus immunoglobulin.

Dose and route of administration

Prevention:

250 IU intramuscularly into the anterolateral thigh.

The single dose is doubled to 500 IU (2 ml) when:

(a) Injury occurred more than 24 hours previously

(b) The patient weighs more than 90 kg

(c) The wound is heavily contaminated

(d) The wound is infected or involves a fracture.

Treatment:

150 IU/kg given in multiple sites. Specific antitetanus immunoglobulin is available in 1ml ampoules containing 250 IU.

Introduction

Human tuberculosis is caused by infection with *Mycobacterium tuberculosis* or rarely *Mycobacterium bovis*. The organism may infect any part of the body; however, the majority of cases involve the respiratory system.

Epidemiology

The incidence of tuberculosis in Ireland has declined from a recorded rate of 230 cases per 100,000 in 1952 to a rate of 10.9 cases per 100,000 in 2000. The number of notified cases declined each year from 1991 to 1997 but increased in 1998 and in 1999. The number of cases fell to 10.9 cases per 100,000 in 2000 with a total of 395 cases. Multi-drug resistant isolates remain very uncommon but demand constant surveillance

The infection is most commonly acquired by aerosol spread; such transmission is more likely when the index case is sputum positive. There were 229 culture positive cases in 2000 which are defined as “definite cases” (WHO).

Effects of tuberculosis

A notified case of tuberculosis refers to clinically active disease due to infection with *M. tuberculosis* complex. Tuberculosis disease is classified as pulmonary, extrapulmonary or both. The majority of new cases are pulmonary.

BCG vaccine

Bacille Calmette Guerin (BCG) vaccine, contains a live attenuated strain derived from *Mycobacterium bovis*. The efficacy of BCG in preventing tuberculosis has varied in reported studies over the years, but is probably most consistently effective against tuberculous meningitis and miliary tuberculosis, with protection lasting approximately 15 years. Irish studies have indicated a protective efficacy of the vaccine against childhood tuberculosis. Indications for BCG vaccine continue to be re-evaluated but at present it is recommended that neonatal BCG be continued.

Dose and route of administration

BCG vaccine may be given concurrently with another live vaccine, but if they are not given at the same time an interval of at least three weeks should be allowed between such vaccines. When BCG is given to infants there is no need to delay the primary immunisations.

Adults and children over three months

The recommended dose is 0.1 ml, by intradermal injection, reconstituted with 1 ml of sterile 'Water for Injection' or normal saline which has been allowed to stand for one minute. Subjects who give a history of previous BCG immunisation should only be given BCG if there is no characteristic scar and they are tuberculin negative. If reimmunisation with BCG is being considered expert advice should be sought.

Infants of three months of age or less

The recommended dose is 0.05 ml, by intradermal injection in two divided doses in adjacent sites. Babies up to three months of age may be immunised without prior skin testing.

The vaccine should be given in the arm, over the insertion of the deltoid muscle.

Once reconstituted and prepared, any vaccine remaining at the end of the session (maximum four hours) should be discarded safely. No further immunisation should be given for at least three months in the arm used for BCG vaccination because of the risk of regional lymphadenitis.

Indications

The vaccine is indicated for prophylactic immunisation in tuberculin negative individuals.

Those at normal risk

(a) Newborn babies
(b) Children or adults where the parents or individuals themselves specifically request BCG immunisation, unless contraindicated
(c) Schoolchildren between the ages of ten and 14 years who have not previously been immunised or who are tuberculin negative and have no characteristic scar
(d) Students in teacher training colleges
(e) Members of the travelling community - due to the logistical difficulties of providing alternative control measures and follow-up of contacts.

Those at higher risk

(a) Health care staff who may have contact with infectious patients or their specimens
(b) Veterinary staff who handle animal species known to be susceptible to tuberculosis

(c) Contacts of cases with active respiratory tuberculosis. Children under five years of age in contact with smear positive tuberculosis should be given chemoprophylaxis and then immunised with BCG on completion of the course if tuberculin negative

(d) Newborn infants where there is a positive family history of tuberculosis

(e) Immigrants from high incidence countries and their children

(f) Those intending to visit high incidence countries for more than a month.

Contraindications

BCG vaccine should not be given to those:

1. receiving corticotrophins or systemic corticosteroid therapy (other than as replacement)
2. receiving other immunosuppressive treatment including x-irradiation
3. suffering from blood dyscrasias, lymphoma, or malignant neoplasms involving bone marrow or the lymphoreticular system, or with gamma globulin deficiency or abnormality
4. with pyrexia
5. with generalised eczema or infected dermatosis. The effect of BCG vaccine may be exaggerated in these patients, and a more generalised infection is possible
6. who are pregnant
7. with positive tuberculin tests.

HIV positivity

BCG vaccine should not be given to HIV positive persons (see Immunisation of HIV positive persons, Chapter 2).

Adverse reactions

Local: Side effects include local induration, pain and occasionally ulceration, lupoid reaction, inflammatory and suppurative adenitis.

General: Rash, fever, and rarely generalised lymphadenopathy can occur.

Interactions

The vaccine should not be given within three months of blood or plasma transfusion or administration of human serum globulin in excess of 0.01 ml/kg body weight.

Introduction

Infection with the varicella-zoster virus causes two distinct clinical syndromes: chickenpox and shingles (zoster). Primary infection results in varicella, an acute exanthematous disease of childhood. The virus becomes latent in the cells of the dorsal root or cranial nerve ganglia and may reactivate after a latent period, which may be several decades. Reactivation results in the clinical syndrome of zoster.

Epidemiology

In temperate climates the incidence of varicella is typically seasonal, reaching a peak from March to May. The incubation period is 14 to 21 days. This may be prolonged (up to 28 days) in individuals who have received specific varicella-zoster immunoglobulin. Transmission is via the respiratory route by inhalation of respiratory droplets or vesicular fluid and less commonly by indirect contact transmission via fomites. Airborne transmission occasionally occurs.

Cases of chickenpox are highly infectious during the two days before the appearance of the rash, until all of the lesions have crusted, which is typically a total of seven days. This infective period may be prolonged in immunosuppressed individuals. In the family setting the secondary attack rate ranges from 60 to 90% for susceptible hosts.

Zoster is transmissable to the non-immune contact as chickenpox, and is less infectious than chickenpox. Transmission is by inhalation or direct or indirect contact with the vesicular fluid. The period of infectivity is from the appearance of the lesions until all lesions have crusted which is typically five days from the onset of the rash. In some clinical circumstances, the viral load and/or viral shedding may be increased with increased risk of transmission. Examples are; disseminated zoster, immunocompetent individuals with exposed lesions (e.g. ophthalmic zoster) or immunosuppressed patients with localised zoster on any part of the body.

Effects of the illness

a. Varicella

- Varicella is typically a benign infection of childhood characterised by a generalised, pruritic vesicular rash. Complications of varicella are uncommon in childhood and

include superinfection usually with the Group A streptococcus, skin scarring in the event of a severe rash, encephalitis, pneumonia, hepatitis and coagulopathy.

- When primary infection occurs in adult life the illness may be more severe; there is an increased risk of complication such as pneumonia or encephalitis and the infection may rarely be fatal.
- Maternal infection in pregnancy also poses a risk to the foetus.
    - Infection in the first five months may result in the congenital varicella syndrome. This syndrome encompasses a range of defects including limb hypoplasia, skin scarring, microcephaly, cataracts and growth retardation. The congenital varicella syndrome is uncommon. A recent large prospective study of women who had varicella in pregnancy found that the risk of the congenital varicella syndrome was 0.4% in the first 13 weeks and 2.0% between 13 and 20 weeks gestation.
    - In contrast, maternal infection in the period from five days before to two days after delivery is associated with a significant risk of severe neonatal infection with visceral dissemination or haemorrhagic varicella.
- Other groups at increased risk of severe complications or disseminated infection include immunocompromised patients, especially those who have leukaemia or others disorders in which there is depressed cell-mediated immunity, and transplant recipients.

b. Zoster

- Zoster is usually a unilateral vesicular eruption in the distribution of a single dermatome.
- Severe pain in the affected area and/or parasthesia is common and may occur prior to the onset of the rash.
- Post-herpetic neuralgia may be severe and is more common in the elderly.
- Zoster is typically found in conditions in which cell-mediated immunity is suppressed such as immunosuppressive therapy, old age or HIV infection. Zoster is rare in childhood but can follow congenital or neonatal varicella.
- Zoster is transmitted to susceptible individuals as chickenpox.
- There is no evidence that maternal zoster poses a risk to the foetus or neonate.

Passive Immunisation: Varicella-zoster immunoglobulin (VZIG)

An intravenous preparation of varicella-zoster immunoglobulin (VZIG) has product authorisation in Ireland. This product "Varitect" is prepared from pooled plasma of donors with a history of recent chickenpox or herpes zoster, or from those who on screening are found to have suitable high titres of V-Z antibody and contains specific antibodies (mainly IgG) against varicella-zoster virus. "Varitect" must be stored at +2 to+8° C protected from light. The solution should be used immediately when ampoules or bottles have been opened and any unused solution discarded.

VZIG should ideally be given within 96 hours of exposure. Although it does not always prevent infection, it will typically attenuate the illness. There is some evidence that VZIG may attenuate the illness if given up to ten days from exposure. Severe varicella may still occur despite VZIG prophylaxis in high-risk groups including immunosuppressed individuals, adults and neonates.

Recommendations for VZIG prophylaxis

VZIG prophylaxis is recommended for individuals who fulfil all of the following three criteria:

a Significant exposure (see below) to:-

(i) Chickenpox

or

(ii) Disseminated zoster or extensive exposed lesions in immunocompetent individuals

or

(iii) Localised or disseminated zoster in immunosuppressed patients.

PLUS

b A clinical condition which increases the risk of severe varicella (see below)

PLUS

c No antibodies to varicella-zoster virus (see below).

a. Significant exposure

In those without immunity to chickenpox, significant exposure is associated with the greatest risk of transmission. The risk following casual contact is negligible. As a guideline, significant exposure includes the following:

- Household contact
- Contact in the same room* for a significant period of time (usually one hour or more)
- Face-to-face contact such as when having a conversation (usually 5 minutes or more)

*An example of “same room” is a classroom or 2-4 bedded hospital bay; this does not usually include a large hospital ward. However, because airborne transmission at a distance has occasionally been reported in large open wards, in this instance the necessity of giving VZIG to all susceptible high risk contacts should be considered on a case-to-case basis, particularly in paediatric wards where the degree of contact may be difficult to define.

b. Clinical conditions which increase the risk of severe varicella.
Such conditions include the following:-

(1) **Neonates**

Infants whose mothers develop chickenpox (but not zoster) in the period from five days before to two days after delivery should receive VZIG.

- Approximately half of these infants may develop varicella despite immunoprophylaxis but the disease is usually modified
- All infants in this group should be carefully monitored; hospitalisation and i.v. aciclovir treatment may occasionally be required
- VZIG is not recommended for full-term healthy infants exposed post-natally to varicella, including infants of mothers who develop varicella 48 hours after delivery
- In the event of significant exposure in the neonatal intensive care unit (NICU), VZIG is recommended for infants of non-immune mothers. Infants born before 28 weeks or whose birth weight is less than 1000g may not possess VZ antibody despite a positive maternal history or titre; all such infants should receive VZIG in the event of significant exposure.

(2) **Pregnant Women**

It is generally recommended that non-immune pregnant woman who have been significantly exposed to varicella should be offered VZIG as soon as possible and preferably within 96 hours of the contact. There is limited evidence that VZIG may modify the illness if given within ten days of the exposure. At all stages of pregnancy the primary aim of VZIG immunoprophylaxis is to modify the illness in the mother. There is little evidence that VZIG will prevent the congenital varicella syndrome

following significant exposure of the non-immune mother in the first 20 weeks. When there are restrictions in the availability of VZIG, priority should be those women at less than 20 weeks gestation and within three weeks of (anticipated) delivery.

(3) **Immunosuppressed patients**

Immunosuppressed patients in whom VZIG is recommended include:

- Patients currently being treated with chemotherapy or generalised radiotherapy, or within six months of completing such treatments
- Patients who have received an organ transplant and are currently receiving immunosuppressive treatment
- Patients who within the previous six months have received a bone marrow transplant
- Children who within the previous three months have received prednisolone, orally or rectally, at a daily dose (or its equivalent) of 2mg/kg/day for at least one week, or 1mg/kg/day for one month. For adults, an equivalent dose is harder to define but immunosuppression may be present in those who have received a dose of around 40mg prednisolone per day for more than one week in the previous three months
- Patient on lower doses of steroids, given in combination with cytotoxic drugs
- Patients with evidence of impaired cell mediated immunity, for example with symptomatic HIV infection. There is no evidence of any increased risk of severe varicella in asymptomatic HIV positive individuals with normal CD4 counts hence VZIG is not indicated in this group
- Patients with immunoglobulin deficiencies who are receiving replacement therapy with intravenous normal immunoglobulin do not require VZIG.

c. No antibodies to varicella-zoster virus

Normal immunocompetent contacts with a definite history of chickenpox are immune; serology or immunoprophylaxis are not necessary and they can be reassured.

The majority of adults and a substantial proportion of children without a definite history of chickenpox will be VZ antibody positive. In all individuals without a definite history or of unknown status who are being considered for VZIG, a serum sample should be tested for VZ antibody; only those without antibody require immunoprophylaxis. However, immunosuppressed

contacts should be tested for VZ antibody regardless of history of chickenpox. When antibody is not detected, VZIG is indicated. To arrange urgent testing for VZ antibody local laboratories should be contacted. Testing will rarely be required outside normal working hours.

VZ antibody detected in patients who have been transfused, or who have received intravenous immunoglobulin in the previous three months, may have been passively acquired. Although VZIG is not indicated if antibody from other blood products is detectable, re-testing in the event of a subsequent exposure will be required as the patient may have become antibody negative.

Dose of VZIG ("Varitect") for prophylaxis

VZIG ("Varitect") is administered by intravenous infusion and is most effective when given within 96 hours of exposure but may be given up to ten days after exposure. A dose of 25 IU (1 ml) per kg is appropriate. The solution must be inspected for particulate matter and discolouration prior to administration; cloudy or discoloured solutions or those that have deposits must not be used. During the infusion, the rate of 1 ml per minute must not be exceeded.

Interactions and adverse effects of "Varitect"

Adverse effects such as nausea, chills, fever, headache, vomiting, allergic reactions, arthralgia and mild back pain may occur occasionally. The efficacy of live attenuated virus vaccines may be impaired, following immunoglobulin administration, for a period of at least six weeks and up to three months.

Active immunisation: Varicella vaccine

Two live attenuated varicella vaccines are available. Product authorisation for these two vaccines has not been sought in Ireland or the UK, and varicella vaccine is available on a named patient basis only. The following risk groups have been shown to benefit from vaccination against varicella; patients with acute leukaemia in remission, patients receiving immunosuppressive therapy, patients with planned solid organ transplantation and patients with chronic disease such as metabolic and endocrine disorders, chronic pulmonary and cardiovascular disease, cystic fibrosis or neurological abnormalities. The prescribing information sent out with the named patient supplies includes particulars of the appropriate time to administer the vaccine.

The dose, contraindications and adverse reactions to varicella vaccine are

detailed in the information provided with the named patient supplies from the manufacturer.

Management of hospital exposure

Hospital staff without a definite history of chickenpox, particularly those working with haematology, oncology, obstetrical, general paediatric or neonatal patients should be routinely screened for VZ antibody. Vaccination should be offered to non-immune staff. Non-immune staff who have had a significant exposure to VZV (see above) should, wherever possible, be excluded from contact with high risk patients from eight to 21 days after exposure.

Workers in many occupations may be exposed to infectious agents. A complete risk assessment should be carried out to determine which, if any, vaccinations are recommended for workers. This should ideally take place pre-placement. Routine review of general immunisation status may also be appropriate. Persons whose work involves international travel should consider the recommendations given in the chapter on travel vaccinations. (Chapter 19)

Decisions about vaccination(s) recommended should be based on the duties of the individual rather than on job title.

These guidelines may change as the prevalence of disease changes.

Categories of Workers

Category A

Frontline healthcare workers, (both clinical and non-clinical), whose work may expose them to blood borne virus infections and other infectious diseases, e.g.

- Medical, nursing and paramedical staff
- Medical and nursing students
- Dentists and dental staff
- Hospital porters and cleaners
- Ambulance personnel
- Other health care personnel deemed vulnerable following risk assessment
  (This may include all persons working “on-site” whether paid or unpaid.)

Hepatitis A

- Hepatitis A immunisation may be occasionally advisable in some of the above categories e.g. paediatric hospital staff, workers who culture hepatitis A, or during local outbreaks of hepatitis A.

Hepatitis B

- All workers in this category should be offered hepatitis B vaccination if not previously vaccinated (see Chapter 6 for immunisation schedule).
- All workers in this category should have anti-HBs levels checked if previously vaccinated against hepatitis B and response not known (see Chapter 6 for adequate response levels).

BCG (Bacillus Calmette Guerin)

- All workers in this category should have pre-employment base-line Mantoux tuberculin testing performed if there is no BCG scar present, or no documented evidence of having received BCG vaccination.
- If there is an inadequate response, then personnel should be referred to the hospital Occupational Physician, or suitable clinician and BCG should be offered (see Chapter 16 for procedure).
- Any health care worker who has been in close contact with a case of smear positive tuberculosis should be referred to the hospital Occupational Physician.
- Persons coming from countries with a high incidence of TB should be screened according to the protocol for immigrants.

Varicella/ Zoster

- Workers without a definite history of chickenpox or vaccination should be considered non-immune and screened for VZ antibody. Vaccination should be offered to non-immune persons working with neonatal or obstetrical patients or those caring for immunocompromised patients. Vaccination may also be considered for other non-immune staff.

Influenza

- Health care workers should be offered vaccination against influenza on an annual basis each autumn.

Measles, Mumps, Rubella

- All health care workers born after 1978 should have proof of immunity or evidence of 2 doses of MMR. Vaccination should be considered for non-immune health care workers working with pregnant women or those working in paediatric, obstetrical or emergency departments.

Category B1

Non-health care workers who share the occupational risk of exposure to blood borne viral infection.

- Members of security and rescue services
- Members of the Garda Siochana
- Members of the Fire Brigade
- Members of the Armed Forces
- Employees of security companies
- Staff of institutions for persons with learning difficulties
- Any other workers who may be exposed to “blood to blood” injuries.

Hepatitis B

- All workers in this category should be offered hepatitis B vaccination if not previously vaccinated (see Chapter 6 for immunisation schedule).
- All workers in this category should have anti-HBs levels checked if previously vaccinated against hepatitis B and response not known (see Chapter 6 for adequate response levels).

Category B2

Prison Officers

Hepatitis A

- Prison Officers in institutions where hepatitis A is occurring should be offered hepatitis A vaccination.

Hepatitis B

- All workers in this category should be offered hepatitis B vaccination if not previously vaccinated (see Chapter 6 for immunisation schedule).
- All workers in this category should have anti-HBs levels checked if previously vaccinated against hepatitis B and response not known (see Chapter 6 for adequate response levels).

BCG

- If there is no BCG scar present, or no documented evidence of having received BCG vaccination, then workers in this category should have pre-employment base-line Mantoux tuberculin testing

performed. If there is an inadequate response, then personnel should be referred to the hospital Occupational Physician, or suitable clinician and BCG should be offered (see chapter 16 for procedure)

- Any worker who has been in close contact with a case of smear positive tuberculosis should be referred to the hospital Occupational Physician.

Category C

- Workers in contact with raw faecal material e.g. sewage workers
- Crèche workers

Hepatitis A

- All workers in this category may be checked for hepatitis A immunity.
- Workers in this category who are not immune to hepatitis A may be offered hepatitis A vaccination. (See Chapter 5 for Immunisation schedule).
- Crèche workers may be immunised against hepatitis A, especially if there is evidence of an ongoing outbreak of hepatitis A.

Category D

- Medical Laboratory Technicians
- Research Scientists dealing with human body fluids

Hepatitis A

- All workers in this category who culture hepatitis A virus should be checked for hepatitis A immunity, and if not immune, should be offered hepatitis A vaccine (see Chapter 5 for immunisation schedule).

Hepatitis B

- All workers in this category should be offered hepatitis B vaccination if not previously vaccinated (see Chapter 6 for immunisation schedule).
- All workers in this category should have anti-HBs levels checked if previously vaccinated against hepatitis B and response not known (see Chapter 6 for adequate response levels).

Polio

- Workers in this category who culture enterovirus should give a history of polio vaccination and may need to be offered immunisation.

Diphtheria

- Workers in this category who handle material that may contain pathogenic corynebacteria may require immunisation. This includes most laboratory staff (see Chapter 3 for immunisation schedule and dosage).

BCG

- Immunisation may be required in certain instances. Workers in this category who culture mycobacteria may require immunisation.

Viral Haemorrhagic Diseases

- Immunisation against diseases such as Lassa fever, Ebola etc. is not presently available, so extra care should be taken when dealing with samples of this nature. (See National Disease Surveillance Centre website (www.ndsc.ie) for up-to-date guidelines).

Category E

- Personnel who work with animals and have exposure to animal tissues e.g. veterinary staff, abattoir workers, zoological workers etc.

BCG

- All workers in this category should have pre-employment base-line Mantoux tuberculin testing performed if there is no BCG scar present, or no documented evidence of having received BCG vaccination.

Rabies

- This may be recommended to those thought to be at particular risk.

Tetanus

- All workers in this category should be immunised against tetanus.

Needlestick Injuries

Needlestick or sharp injuries may occur in the health care sector. Some of these may leave a person at risk of getting hepatitis B, hepatitis C or HIV. Such injuries should be assessed by a competent person e.g. Occupational Physician or Infectious Diseases Consultant.

In the first instance, the wound should be washed and all appropriate first aid given. Health care workers should contact their local occupational health department. In the absence of such a service, or outside of office hours, the

person getting such an injury should go to their local Accident and Emergency Department. A risk assessment will then carried out. If appropriate, the Occupational Physician or Infectious Diseases Consultant (or their team) should be contacted. Such risk assessment includes details of the source patient's risk status (if known). A blood sample from the source patient should be taken (with consent) and tested for viruses.

If the health care worker getting a needlestick injury has not been adequately vaccinated against hepatitis B, then hepatitis B prophylaxis should be considered. Specific hepatitis B immunoglobulin is available for passive protection and is usually used in combination with hepatitis B vaccination to confer passive/ active immunity after exposure. If they have had a previous needlestick injury, or recent hepatitis B vaccination, it may not be necessary to give hepatitis B immunoglobulin as the results of any previous hepatitis B test may be available within 72 hours.

If the needlestick or sharp injury was from a source believed to be HIV positive, then post exposure prophylaxis with antiviral therapy should also be considered. This should be undertaken urgently. As the drug regime for such antiviral prophylaxis changes regularly, it is not possible to go into the details of such therapeutic protocols in these guidelines. The local Occupational Physician or Infectious Disease Consultant will be able to give further details on this and should be contacted in such instances.

Introduction

The increase in international travel has continued to grow over the past decade and the current projections suggest that this pattern will be maintained. Infectious diseases remain a serious problem for both the individual traveller and also as a public health issue. Health information for international travel is become increasingly complex because of a resurgence of old conditions (e.g. malaria; tuberculosis, syphilis, diphtheria), drug resistance to existing conditions (e.g. malaria; salmonellosis), the appearance of new infections (e.g. Lyme disease, Hantavirus, *E. coli O157*) and the increase in holiday travel particularly to remote parts of the world.

Questions to be addressed by the doctor for those intending to travel include:-

(a) Is the individual medically fit to travel?

(b) What immunisations are necessary?

(c) Is the provision of prescriptions/tablets necessary?

(d) Does the traveller have health insurance, including air ambulance insurance, if travelling to areas where medical care may be severely restricted?

(e) Has the traveller had a dental check-up? (Dental treatment is to be avoided in countries where sterilisation may not be adequate because of the particular risk of hepatitis B and AIDS.)

On return, any unusual symptoms should be treated with a high degree of suspicion of tropical disease for a period of at least a year. Some conditions can exhibit significantly longer incubation periods (e.g. Malaria, Schistosomiasis, Leishmaniasis)

Immunisations

Immunisations are available against a number of infectious diseases and their use may be considered for international travellers. Ideally, they should be commenced several weeks prior to travel. For most travellers four to six weeks should be sufficient but even up to six months may be required for those who will be at higher risk due to trekking or those planning to live overseas.

Advice to individuals will depend not only on the entry regulations for each country to be visited, but also the season, the length of stay, the age and medical history of the traveller and the type of stay (e.g. urban/rural, camping, trekking, hotel).

Regulations regarding entry requirements of countries can be obtained from travel agencies in this country and the relevant Embassies, Diplomatic or Consular Missions.

Yellow Fever (notifiable)

Yellow fever is an acute viral infection spread by mosquitoes and which in its severest form presents with haemorrhage and jaundice.

Yellow fever vaccine

This is a live virus vaccine, which may only be given under approved arrangements, and a list of yellow fever Vaccination Centres is available from the Health Boards. Primary immunisation against yellow fever is valid after l0 days for a ten year period and re-vaccination is valid immediately for a further ten years.

Dose and route of administration

The dose is 0.5 ml., s.c. in those over nine months of age.

Indications

A valid certificate of vaccination against yellow fever is required if travelling to a yellow fever area (chiefly Equatorial Africa and regions of South America) and by certain other countries if the traveller has recently travelled through a risk region.

Contraindications**

1. High-dose systemic corticosteroid or immunosuppressive treatment including radiation.
2. Malignant conditions (e.g. lymphoma, Hodgkin's Disease) or where the immunological mechanism may be impaired (e.g. hypogammaglobulinaemia).
3. Pregnancy - because of the theoretical risk of foetal infection. However, if a pregnant woman must travel to a high-risk area she may be considered for immunisation since the risk from yellow fever may

outweigh that of immunisation.

4. True anaphylaxis to egg or hypersensitivity to neomycin or polymyxin or previous serious reaction to the vaccine.
5. Symptomatic or asymptomatic HIV positivity.

** A letter from the physician stating the reason why immunisation is contraindicated may be acceptable in some countries but advice should be sought from the relevant Embassy. Such a letter should be written on professional notepaper, signed with degrees and stamped by the local Health Board, which verifies that the signatory is a medical practitioner in the area.

Adverse reactions

(a) Severe reactions are very rare. Five to ten percent of recipients have mild headache, myalgia, low-grade fever or soreness at the injection site five to ten days following immunisation.

(b) The only serious reaction has been the rare occurrence of encephalitis in young infants, all of whom have recovered without sequelae.

Precautions

Acute febrile illness (Immunisation should be postponed).

Meningococcal infection (notifiable)

Meningococcal Vaccine (see Chapter 9).

Indications

There are areas of the world where the risk of acquiring meningococcal infection is very high, particularly for those visitors who live or travel “rough” such as hitchhikers or “trekkers”. These areas include the meningitis belt of Africa (Southern sub-Saharan parts of Senegal, Mali, Niger, Chad and Sudan; all of Gambia, Togo and Benin; Northern parts of Sierra Leone, Liberia, Ivory Coast, Nigeria, Cameroon, Central African Republic, Uganda and Kenya) where epidemics of Group A infections occur in the dry season (December-February); Nepal, Mecca and areas of New Delhi.

Immunisation is recommended for travel to areas where epidemics due to meningococci Group A or C occur. Vaccine containing A and C is usually

adequate for travel purposes. A quadravalent vaccine containing A,C,Y & W135 is required for entry during the Hajj festivities in Saudi Arabia.

Adverse reactions

Local: injection site reactions occur in approximately 10% of recipients and last for about 24-48 hours.

General: generalised reactions are rare but pyrexia occurs more frequently in young children than adults.

NOTE: It should be remembered that conjugate meningococcal C vaccine confers no protection against the serotype A version of this disease which is the most common form found in many of the tropical regions of the world.

Cholera (notifiable)

Cholera is an acute diarrhoeal disease caused by an enterotoxin of *Vibrio cholera*, which has infected the small bowel. The illness is characterised by the sudden onset of profuse watery stools and occasionally vomiting. Dehydration, metabolic acidosis and circulatory collapse may follow rapidly.

Cholera vaccine

Cholera vaccine is not currently available in Ireland. The World Health Organisation recommended against the use of the older parenteral vaccine for travellers in 1973. Newer more efficient vaccines against cholera should be available in the near future.

Nevertheless, border officials may sometimes ask people travelling from infected areas for evidence of immunisation against cholera. Such travellers are therefore advised to have a certificate of exemption rather than risk having injections abroad.

Typhoid (notifiable)

Typhoid fever is a systemic infection caused by *Salmonella typhi*. Most of the approximately 2000 serotypes in the genus salmonella cause only local infection of the gastro-intestinal tract (gastro-enteritis or “food poisoning”). *S. typhi, S. paratyphi* A, B and C and occasionally other salmonella species may invade systemically to produce a serious illness with prolonged pyrexia and prostration. The likelihood of becoming a chronic carrier increases with age.

Typhoid/paratyphoid fevers are acquired mainly through food or drink contaminated with the excreta of a human case or carrier. It is therefore

predominantly a disease of countries with poor sanitation and poor standards of personal and food hygiene.

Typhoid vaccine - Parenteral

Vi polysaccharide vaccine: Parenteral capsular polysaccharide typhoid vaccine is available. Each 0.5 ml dose contains 25 mcg of the Vi polysaccharide antigen of *S. typhi* preserved with phenol. A single dose gives 70-80% protection for at least three years.

Typhoid vaccine - Oral

Oral Ty 21a vaccine: An oral typhoid vaccine, which is a live vaccine is also available. Attenuated *S. typhi*, strain Ty 21a, is contained in an enteric-coated capsule. One capsule taken on alternate days for three doses (days 0,2,4) appears to produce similar efficacy to parenteral vaccines, although the length of protection in those not repeatedly or constantly exposed to *S. typhi* may be less. The vaccine is unstable at normal room temperatures.

Typhoid vaccines should be stored at 2-8°C and not frozen.

Dose and route of administration -

Adults

(a) Vi polysaccharide vaccine: a single intramuscular or subcutaneous dose (0.5ml) is given. Reimmunisation with a single dose every three years is recommended for those who remain at risk of infection.

(b) Oral Ty 21a vaccine: one capsule on alternate days for three doses should be taken. Those taking the vaccine home must be instructed to keep it in the refrigerator between doses and on abstaining from warm/hot drinks or meals for one hour after administration.

Children

(a) Vi polysaccharide vaccine: The risk for children developing typhoid under one year is low. Children under 18 months may show a suboptimal response to polysaccharide antigen vaccines. Use of the vaccine in this age group should therefore be governed by the likely risk of exposure to infection. Children over the age of two years may receive the normal adult dose.

(b) Oral Ty 21a vaccine: Oral typhoid is unlicenced for children under the age of six years. Over this age the normal adult dose is given.

Indications

Typhoid immunisation is required for:-

- Laboratory workers handling specimens which may contain typhoid organisms
- Travellers to countries in Africa, Asia, Central and South America and South East Europe, and to other areas where hygiene is likely to be poor
- Typhoid immunisation is not recommended for contacts of a known typhoid carrier or for controlling common-source outbreaks.

Contraindications

1. Severe reaction to a previous dose of the same type of vaccine
2. Oral Ty 21a vaccine should not be given to those taking sulphonamides or antibiotics
3. Oral Ty 21a vaccine is contraindicated in those with immunosuppression due to disease or treatment
4. Oral Ty 21a vaccine contains live organisms and is contraindicated in HIV positive persons however polysaccharide typhoid vaccine is not and may therefore be given to HIV positive individuals in the absence of contraindications.

Precautions

1. Acute febrile illness (Immunisation should be postponed)
2. As with other vaccines, typhoid vaccine should only be given to a pregnant woman if a clear indication exists
3. The course of oral Ty21a should be completed at least three days before beginning a course of Mefloquine for malaria prophylaxis
4. Oral Ty 21a vaccine should be separated from oral poliomyelitis vaccine (Sabin) by an interval of at least three weeks.

Adverse Reactions

Vi polysaccharide vaccine: Local reactions are reported to be mild and transient and systemic reactions are less common than with the whole cell vaccine.
Oral Ty 21a vaccine: Oral Ty 21a vaccine may cause transient mild nausea, vomiting, abdominal cramps, diarrhoea and urticarial rash.

Japanese B Encephalitis (notifiable)

Epidemics of this condition occur in Asia most frequently associated with the monsoon season. It is usually a disease of rural regions. The case

fatality can reach 20%. Culex mosquitoes spread the virus. The vaccine should be offered to expatriates who plan to reside in endemic areas and travellers spending more than thirty days in such areas, or to those whose type of activity places them at risk. If indicated further detailed information should be sought from specialised centres or the Departments of Public Health in each Health Board.

Tick Borne Encephalitis (notifiable)

This viral disease occurs sporadically through parts of eastern and central Europe. Disease transmission primarily occurs during the spring and summer months in those exposed to tick bites. Travellers planning to camp or trek through forests or to walk along nature trails should consider having prior vaccination as currently no therapy exists for this disease. If indicated further detailed information should be sought from specialised centres or the Departments of Public Health.

Rabies (notifiable)

Rabies is an acute viral infection resulting in encephalomyelitis, which is almost always fatal, death resulting from respiratory paralysis. The incubation period is generally between two and eight weeks but may range from nine days to two years or even longer. Infection is usually transmitted by the bite of a rabid animal. Any warm-blooded animal may be infected but amongst domestic animals, dogs and cats are most commonly infected; in the United States, amongst wild animals, skunks, racoons and bats account for 85% of animal cases. Monkey bites among tourists are also of particular concern, though it must be emphasised that any bite, lick or scratch from a warm-blooded animal in an endemic area must be considered as a high risk and further specialised advice should be sought as soon as possible.

Rabies vaccine:

Rabies vaccine is used for pre-exposure protection of those at risk. It may also be used in combination with rabies specific immunoglobulin, for rabies post-exposure treatment. Human diploid cell rabies vaccine (HDCV) is a freeze-dried suspension of Wistar rabies virus strain PM/W1 38 150-3M cultured on human diploid cells and inactivated by beta-propiolactone. The potency of the reconstituted vaccine is not less than 2.5 IU per 1 ml dose. The freeze-dried vaccine should be stored at 2-8°C. It should be used immediately after reconstitution with the diluent supplied and any unused vaccine discarded after one hour. It may be given by deep subcutaneous, intramuscular or intradermal (unlicensed) injection usually in the deltoid region. The vaccine contains traces of neomycin.

Rabies-specific immunoglobulin:

Human rabies immunoglobulin (HRIG) is obtained from the plasma of immunised human donors. It is used after exposure to rabies to give rapid protection until rabies vaccine, which should be given at the same time, becomes effective. Up to half the calculated dose is infiltrated in and around the wound after thorough cleansing and the rest is given by intramuscular injection.

Dose and route of administration

For primary pre-exposure protection, four 1.0 ml doses of HDVC should be given, one each on days 0, 7, 28 and 365, by deep subcutaneous or intramuscular injection in the deltoid region (the antibody response may be reduced if the gluteal region is used). The same dose is used for adults and children. All travellers to areas of risk should be informed by their medical advisors to seek immediate medical aid if an animal bite or scratch is sustained. Although it is not licensed for intradermal use, intradermal administration of 0.1 ml has been found to be as immunogenic as 1ml via the intramuscular route.

Single booster doses of vaccine should be given at two to three year intervals to those at continued risk.

The three initial primary dose pre-exposure course produces protective antibody in virtually 100% of recipients and makes routine post-immunisation serological testing unnecessary. Serological testing is advised for those who work with live virus and such persons should have their antibodies tested every six months and be given booster doses of vaccine as necessary to maintain protective levels. Serological testing is otherwise only advised for those who have had a severe reaction to a previous dose of vaccine to confirm the necessity of a booster dose.

Indications

Pre-exposure prophylaxis should be offered to those in the following categories:

- Laboratory workers handling or potentially handling the virus
- Those from endemic areas, who by the nature of their work are likely to be in direct contact with imported animals: those at animal quarantine centres; at zoos; at research and acclimatisation centres where primates and other imported animals are housed; at ports (e.g. Customs and Excise Officers); authorised carrying agents for imported animals; veterinary and technical staff at the Department of Agriculture

- Workers in enzootic areas abroad at special risk (e.g. veterinary staff, zoologists)
- Healthcare workers who are likely to come into close contact with a patient with rabies
- Those living or travelling in areas who may be exposed to unusual risk of being infected or are undertaking especially long journeys in remote parts where medical treatment may not be immediately available.

Contraindications

I. There are no absolute contraindications to HDCV although if there is evidence of hypersensitivity subsequent doses should not be given except for treatment

2. Pre-exposure vaccine should only be given to pregnant women if the risk of exposure to rabies is high.

Further information on rabies vaccine and post-exposure treatment is available from specialised centres and the Departments of Public Health.

Post exposure treatment

Travellers who have been exposed to the possibility of rabies while abroad should seek immediate medical attention. On return to Ireland they should contact their general practitioner or specialised vaccination centre to receive further advice. Post exposure prophylaxis with the HDCV is currently available free of charge through the National Fever Hospital in Cherry Orchard. It is anticipated that a supply of hyperimmune serum will also be maintained at this centre. Human Rabies Hyperimmune Serum is also available from C.D.S.C., 61 Colindale Avenue, London NW9 5EQ, Tel. No. 0044 208 2006868.

Adverse reactions

(a) HDCV may cause local reactions such as redness, swelling or pain at the site of injection within 24-48 hours of administration. Systemic reactions such as headaches, fever, muscle aches, vomiting and urticarial rashes have been reported. Anaphylactic shock has been reported from the USA and Guillain-Barre Syndrome from Norway. Reactions may become more severe with repeated doses.

(b) HRIG may cause local reactions and low grade fever but no serious adverse reactions have been reported.

Diphtheria (notifiable) (see Chapter 3)

It should be re-emphasised that children aged ten years and over and adults should not be given the higher strength childhood vaccine due to the possibility of anaphylactic reaction. A low strength diphtheria vaccine is available either as a monovalent vaccine (unlicenced-named patient basis) or in combination with Tetanus.

Other immunisations

Advice about other immunisations will always be tempered by the length of time to be spent abroad, the location, and if camping/trekking is intended. If more than one live vaccine is required, they should either be given at the same time in different sites, or at an interval of three weeks. (Check relevant sections within this booklet).

Poliomyelitis (see Chapter 13)

Transmission of poliomyelitis in many regions of the world has been significantly lessened during the past 20 years and so the risk of infection for the international traveller is small. In most cases vaccination is no longer recommended for those visiting any region in the Americas and it is likely that the recommendations for SE Asia will also change during the next few years. Most disease risk currently occurs through the Indian and African subcontinents.

Gammaglobulin

This drug provides passive immunity against hepatitis A and has been used for this purpose since the early 1940's. It is no longer available in Ireland at this time. Current internationally accepted advice suggests that active vaccination against hepatitis A (even at short notice before potential exposure) provides adequate protection. Travellers presenting within ten days of travel should be advised of the potential risk of vaccine failure and the need to exercise extra precautions during this initial period.

Aluminium containing vaccines

Generally, a number of vaccines can be safely given on the same occasion but care is required to avoid giving certain vaccines in the same location on the one occasion. This is particularly important with regard to vaccines containing aluminium as an adjuvant.

Vaccines currently containing Aluminium are:

- Active hepatitis A vaccines
- Active hepatitis B vaccines

- Tetanus toxoid vaccines
- Polio Salk vaccine
- Conjugate meningitis C vaccine.

Adults (see relevant chapters)

Immunisation history should be checked to confirm adequate protection, including need for appropriate booster doses, against the following diseases:-

- Diphtheria
- Tetanus
- Poliomyelitis
- Pneumococcal infection (if an underlying condition is present that predisposes to infection e.g.. asplenia; see relevant section)
- Measles (for those without physician-diagnosed measles or positive immunological test)
- Tuberculosis status testing (Heaf / Mantoux for persons planning an extended stay in developing countries)
- Hepatitis A
- Hepatitis B
- Meningococcal infection
- Typhoid
- Rabies
- Japanese B encephalitis.

Those undertaking regular long haul flights should also consider receiving influenza vaccine at the appropriate time of the year.

Health information

It is important to remember that the commonest illnesses acquired abroad are preventable by measures other than vaccines:

Diarrhoea

Diarrhoea affects around 50% of travellers. It, and other diseases such as hepatitis A and typhoid fever, is preventable by proper attention to personal hygiene and the type of food and drink consumed. Beware of water, ice, salads, uncooked/reheated foods, raw eggs, unpasteurised milk and milk products (e.g. cheese) and peeled fruit. Canned beverages or beer/wine should be used. Consumption of undercooked bivalve shellfish (e.g.

mussels, oysters, clams, etc) present particular risks while abroad.

Malaria (notifiable)

The number of cases of malaria has increased over the past ten years because of increased travel, poor quality/contradictory advice on prophylaxis with resulting poor compliance and also because of resistance to drugs.

About 100 cases of malaria are reported annually in Ireland among returned travellers. No one agent can guarantee safe and effective protection against malaria but drugs are very important in prophylaxis.

Antimalarial drugs must be taken as recommended. They are usually taken one week or more before travelling, during the stay and four to six weeks after leaving the infected area. Travellers should be informed that there is no vaccine currently available to protect against malaria.

Cases result from failure to protect against mosquito bites, failure to take appropriate chemoprophylaxis or from poor compliance. Malaria is endemic chiefly in Central Africa, South America and parts of Asia, however the risk is greatest in sub-Saharan Africa.

While prophylactic drugs are important, advice should also given to avoid exposure to mosquito bites; to cover arms/legs with long clothing in the evening when the mosquitoes are most active, to use insect repellents, mosquito netting and window or door screens.

Malaria can present clinically many months or years after exposure despite full prophylaxis at the time of exposure.

Pregnant women and small children are at special risk from malaria and, where possible, should not travel to malarial areas.

If indicated further detailed information should be sought from specialised centres or the Departments of Public Health in each Health Board.

Acquired Immune Deficiency Syndrome (AIDS)

Travellers should be told that there are no AIDS-free areas of the world and advised of the dangers of unprotected casual sexual contact. They should also be advised to be accident-wise because of the risk of AIDS transmission in some countries through blood transfusion.

A dental check prior to travel is recommended and it may be wise to carry sterile syringes/needles in case an injection is necessary.

Those planning to live overseas for prolonged periods of time should attend for medical advice regarding immunisations and general health care advice in sufficient time before their departure. Generally periods up to six months may be required and this should be considered when booking their itinerary.

Visiting friends & relations

This category of traveller is a new entity for Irish practitioners. Generally these patients will be visiting family and friends in their country of origin and in many cases they will be in rural regions where the risk of disease is high. If visiting particular higher risk countries, they may also be resistant to the suggestion that malaria prophylaxis and vaccination cover will be required. It should be remembered that natural immunity against a number of diseases drops rapidly once an individual is not continuously exposed. Thus following a stay in Ireland of over six months it should be assumed that an individual will have lost all natural protection against a disease such as malaria. Generally malaria prophylaxis and vaccination cover for this group should be the same as that suggested for any other traveller.

Further information

The Health Promotion Unit of the Department of Health and Children has booklets available entitled “General Health Information for People Travelling Abroad”. Supplies of this booklet are free of charge and readily available. (The Health Promotion Unit, Department of Health and Children, Hawkins Street, Dublin 2. Tel: 635 4000).

The World Health Organisation produces a yearly guide International Travel and Health, *Vaccination Requirements and Health Advice for the International Traveller*. Supplies are available through local medical bookstores or directly from WHO in Geneva (Tel +4122 791 2476 e-mail publications@who.ch)