Social Support for Immunodeficiency Patients

Allergy and Immunology Awareness Program

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HEALTH • EDUCATION • RESEARCH
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Contents

Hereditary (genetics)

a. The fundamentals

All our features, such as our height, the colour of our eyes and our hair, are defined by the genes we have inherited from our parents.

In the last few years it has become possible to map almost all human genes (the genome), and many of the genes responsible for PIDs have been identified.

However, there are still a great many unanswered questions, and the hunt for other genes which cause PIDs therefore continues. A good example of that is the research in association with the mapping of the genes causing Common Variable Immune Deficiency (CVID).

All human cells contain a complete set of human genes, a genome, apart from sperm cells and eggs, which contain only a half copy, but which on fertilization merge to form a whole set (half from the mother, the other half from the father).

All the genes are enclosed in the chromosomes, which are situated in the cell nucleus. The chromosomes are present in pairs, and a normal human cell contains 46 chromosomes, a total of 23 pairs.

22 of the pairs are called "autosomes". The last pair is termed "sexual chromosomes". X (female), and Y (male). A woman has two X chromosomes, and a man has one X chromosome.

Every chromosome has two "branches": a short branch termed "p" and a long branch termed "q".

We inherit one chromosome of each pair from our mother, and the other chromosome of the pair from our father. Since the genes are present in the chromosomes, we inherit two copy of every gene, one from each of our parents.

If one copy of a gene fails to work properly, the other copy is often able to compensate. But if both gene copies are defective, compensation is not possible. In boys who inherit a defective X chromosome from the mother, there is no copy which can compensate, because he has a Y chromosome from his father.

Each human cell nucleus contains about 100,000 genes.

A gene is made up of a sequence of DNA (deoxyribonucleic acid). Such a DNA sequence can be compared to a bar code, familiar to us from price labels in shops.

Each gene contains codes (instructions) which allow the cell to produce a particular product: e. g. a protein or an enzyme. (Proteins are large components of all cells. Enzymes are proteins which assist in chemical processes).

DNA consists of four "building blocks": Adenine (A), Thymine (T), Guanine (G), and Cytosine (C), just like a huge box or Lego bricks which are colored: red, green, yellow or blue.

These building blocks can combine in an incredible number of ways. They are localized in pairs in a double stranded helix, which is encapsulated in the chromosomes.

The DNA is thus a database, containing millions of chemical building blocks.

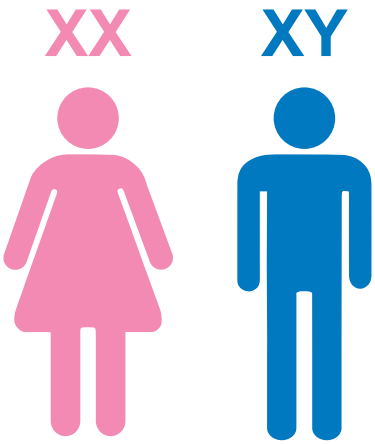
When the DNA sequence is correct, our body develops properly and functions normally. But tiny changes (mutations) in just one gene can have very great consequences and lead to congenital defects – not only in the immune system, but throughout the body.

Fig. VII.1

b. Genetic definitions

Autosomal chromosomes
An autosomal chromosome is not a chromosome which is not a sexual chromosome (X or Y).

Sexual chromosome
Women have X + X, while men have X + Y



Recessive
The definition of a recessive gene is, that it is "shouted down" by, or gives way to the stronger (dominant) gene in the same pair of chromosomes.

Dominant
A dominant gene "shouted down" other genes, and thus will thus always be manifested in possible disease.

Mutation
Even if neither of the parents has defective genes, a mutation may occur, that is to say an inexplicable change in the genes in one or both the parents, sexual cells (egg or sperm), but not in other cells of their body. New mutations are responsible for a significant proportion (up to one third) of sex-linked (X-linked) immune defects.

Carriers
A carrier is a person whose genes are defective, but where this defect does not have an impact. In some cases a carrier of sex-linked (X-linked), recessive immune defects is found by laboratory tests (gene tests). In other cases the defect is not discovered until a child is born with the disease.

c. Types of inheritance of genetic diseases

The diseases with defects in a single gene come under one of the following categories:

Autosomal recessive

This diseases occur when a person inherit two defective recessive genes, located on the autosomal chromosomes (non-sexual chromosomes), one chromosome from each parent. Both parents are healthy carriers. The disease may affect boys as well as girls. In every pregnancy there is a 25 per cent risk of the child having the disease; there is a 50 per cent risk of the child being healthy and not a carrier of the disease.

Autosomal dominant

This meaning that the disease is caused by a single dominant gene. One of the parents is not only a carrier of the disease but has the disease. Every child in the family has a 50 per cent risk of inheriting the sick gene and therefore the disease.

Lowered penetrance

This is the phenomenon whereby less than 100 per cent of individuals with a particular gene type (possibly causing disease) actually have the disease in question.

Sex-linked (X-linked) recessive

Sex-linked diseases are caused by defective genes, localized on the X chromosome. Although we have two copies of almost all genes, men have only one X chromosome, and thus have only one copy of the genes on that chromosome. If a man inherits a defective gene, he has no reserve system which can compensate, and he will therefore inherit the disease.

Sporadic inheritance

Not all immune defect diseases can be traced back to a single defective gene, because there is no family pattern of inheritance. This phenomenon is known as sporadic inheritance. A sporadic defect may be the result of several defective genes acting together, or there may be an interaction between particular types of genes and environmental factors. They may also be caused by changes in the genes which have arisen during the person's life. They may perhaps have resulted from new mutations in the sexual cells, or be the visible manifestation of inheritances not yet recognized.

d. Research into heredity (the genes)

Sometimes the same, or almost the same, symptoms may be a result of different defective genes. For example the different types of SCID may be a result of mutations in different genes. One genetic defect may block the activation of T and B cells. Another genetic defect impedes the immune cells in getting rid of their poisonous chemicals. The result is the same: significant parts of the immune system do not function properly.

In research into genes it is not only a question of localizing and identifying the single gene. The primary task is to find out what the gene normally codes for, that is to say for which protein, enzyme or signaling substance it contains the recipe.

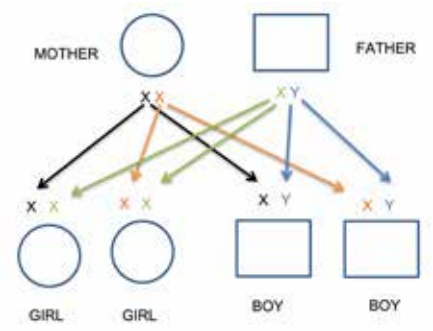
It may be signaling substance which prompt the cells to divide or mature, or proteins, which help the cells to get rid of surplus or unwanted cells.

The next step to establish what happens, when the protein, enzyme or signaling substance is missing or is defective, and how this can cause a disease or immune deficiency.

After these processes a way of compensating for the defect or a cure for the disease may begin to be found.

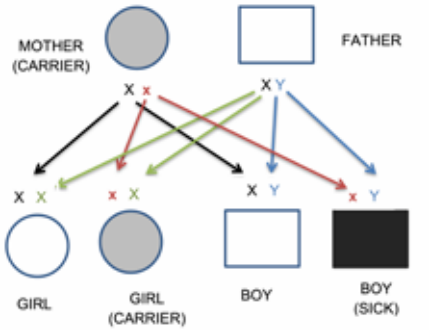
Inheritances

Normal inheritance:



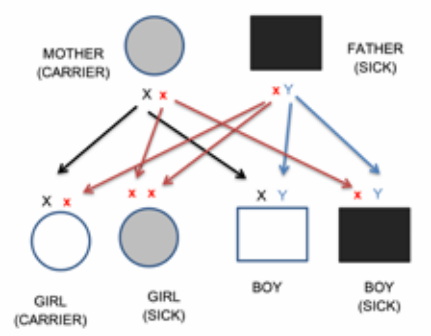
X-Linked, Recessive inheritance:

In the case shown, the mother is a carrier of a recessive gene on one sex chromosome. If this defective gene is passed on to a son, then he may have the disease, because he does not have a healthy gene from his father.



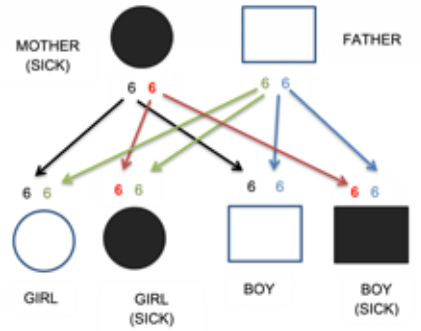
Both parents, recessive inheritance:

In this example both the mother and the father have a defective, but recessive gene on the X chromosome. Girls as well as boys may thus inherit the disease, without the parents being sick.



Autosomal dominant inheritance:

Inheritance is said to be dominant when the single gene inherited is "strong enough" to dominate the other gene inherited. A dominant gene will thus "shout down" another gene, and therefore always result in possible disease. In the example the mother has a dominant gene (6) on chromosome pair number 6.



Immunization

There are inequalities between the current immunization schedules of children in different countries:

Specific antibodies ought to be checked before and four weeks after immunization of immunodeficient individuals.

Immunizations are usually given in the primary health sector.

It is precisely in suspected or verified immune deficiency that immunizations should take places as far as possible.

If relative or absolute contraindications are found, it is recommended that the responsible doctor should be contacted beforehand.

a)Immunization not advisable (contraindicated):
Allergic reaction:

Earlier severe reaction against a vaccine or one of its components is an absolute contraindication for use of the same vaccine again.

A known egg allergy should not usually an impediment to MMR in a hospital outpatient setting.

Information concerning asthma, eczema, cold, current antibiotic treatment or breast feeding is not a relative contraindication for vaccination according to schedule.

Immune deficiency:
(Live vaccines)

In general immunization with live, attenuated (weakened) bacterial and viral vaccines is not recommended for children with primary or secondary severe immune deficiency, including children receiving long-term high-dose steroid treatment (> 2 mg prednisone/kg/day) or chemotherapy.

1. MMR vaccine:
The only live, attenuated vaccine is part of the routine childhood immunization program).

This vaccine is not given to children with inborn severe immune deficiency, i. e. severe combined ID (SCID).

Children with a low lymphocyte count (lymphopenia) (1200/µl) or malignant diseases should not be immunized.

Children with HIV infection can be immunized with MMR provided they are not suffering from AIDS or severe immune suppression (CD4 count: 750/µl 1 – 5 years of age, and < 200/µl > 6 years of age).

2. BCG vaccine:
Tuberculosis vaccine – contains live, attenuated BCG bacteria) is contraindicated for children with chronic granulomatous disease, interferon-y receptor and interleukin-12 deficiency, T cell deficiency, and for children with HIV in industrialized countries.

3. OPV vaccine:
(polio sugar lump – contains live, attenuated polio virus): is contraindicated in immune deficiency.

4. Varicella vaccine:
(chickenpox – live, attenuated varicella – zoster virus (VZV)).
Indications: for VZV antibody negative children before organ transplantation or in leukaemia (after assessment by a specialist).

5. Yellow fever vaccine:
WHO recommends that all travelers to countries in area, where Yellow fever is present, e. g. tropical Africa and South America (but not Asia) between 15 latitude North and 15 latitude South are immunized not later than ten days before travel.

Contraindications:
Pregnancy, and age less than one year.
Proven, significant allergy to eggs (i. e. on an egg-free diet).
HIV with CD4 count <500/µl 1 – 5 years of age, and < 200/µl > 6 years of age, or symptoms of AIDS.
PID
Secondry ID (malignant diseases, chemotherapy, high dose steroid treatment (>2 mg prednisone/kg/day for more than 14 days, less than 2 years after transplantation).

6. Rota virus vaccine:
Can be given orally from the 6th week of age in 3 doses (Rotateq®), or 2 doses Rotateq® - with intervals of 4 weeks. The vaccine has gained access into the national immunization program of many countries.
Denmark's final decision not to vaccinate was reached in the mouth of October 2012. The reasons for the slow progress in Europe include low mortality from ROTA virus gastroenteritis, unfavorable cost-benefit calculations, and concerns over intussusception. The vaccine is contraindicated in children with SCID= severe combined immune deficiency.

b) Immunization justified (indicated):
(killed vaccines:)

1. Influenza vaccine:

a) Children older than 6 month with immune deficiency, including children infected with HIV, once a year.
b) Chronic lung diseases (well treated asthma not included).
c) Cardiovascular diseases.
d) Diabetes mellitus.
e) Persons over 65 years old.

2. Pneumococcus vaccine:
The 23-valent polysaccharide vaccine, Pneumovax® is recommended for persons older than 65 years and other risk groups of more than 2 years ago.

Since 1st October 2007 the 7-valent protein-conjugated vaccine Prevenar®, has been included in the children's routine immunization schedule.

Immunization of non-covered risk groups:
Absolute solution:
Asplenia (absence of normal spleen function) – congenital, after surgery, or functional (sickle cell anemia).

Measurement of antibody levels after 5 years, more often in immunodeficient individuals.

Relative indications:
- Cerebrospinal fluid leakage (open connection to the brain/spine)
- History of invasive pneumococci infection (blood poisoning or meningitis)
- Congenital heart disease (cyanosis, cardiac insufficiency, not radically operated)
- Chronic lung diseases (not including well managed asthma): cystic fibrosis, ciliar deficiency, bronchiectasis.
- Respiratory insufficiency, secondary to nerve/muscle diseases.

- Nephrotic syndrome (hypogammaglobulinemia, immunoglobulin deficiency secondary to loss of protein in the kidneys).
- Primary immune deficiencies (excluding SCID and agammaglobulinaemia – because of immunoglobulin substitution).
- Severe secondary immune deficiency.
- Transplantation.

3. Meningococcus vaccine:

Indications:

I. Contact in the household with cases of meningococcal disease (not type B); if several cases occur in wider circled the offer of immunization could be extended.

II. Complement deficiency (the risk of meningitis is increased by a factor of 400).

Administration of meningococcal vaccine:Children, aged 2 – 12 months: conjugated meningococcal type C, Neis Vac - C®, where appropriate together with the routine immunizations, given 3 doses at a interval of at least one month.
Children aged 13 – 24 months: 1 dose.

Children more than 2 years old (including younger children already immunized): Polysaccharide vaccine, Meningovax A + C®, given 2 doses at an interval of 3 years.
Despite the above immunizations it is necessary still to be aware of the following meningitis symptoms:
A high temperature, severe headache, nausea and vomiting, increasing clouding of unconsciousness, neck and back stiffness, punctiform haemorrhages in the skin.

In the case of symptoms treatment with penicillin is started at once (150,000 units/ kg orally).

The treating doctor should be informed of genetically increased risk of meningococcal disease. Phone for an ambulance or take the patient to hospital yourself.

4. Hepatitis B vaccine:

Indications:

- Children of women with chronic hepatitis B (pos HB s Ag): administer specific immunoglobulin and immunize at birth, then revaccinate when the age of the child is 1, 2 and 12 months old.
- Child with hepatitis B in an institution: children and employees are offered immunization.
- Children with Down syndrome.
- Injecting drug users.
- Healthcare professionals exposed to blood, particularly surgeons.

Social support

The life of the family with a primary immune deficiency

Primary (inborn) immune deficiency is a rare disability. And its infrequency is the precise reason for the particular problems encountered by people who suffer from these diseases.

Often the patients experience problems in obtaining the correct diagnosis, treatment, and adequate counselling and support.

The course of the disease – from the onset of the initial symptoms until the final diagnosis is made – is usually a protracted process, which is characterized by uncertainly and anxiety.

In some people the course of disease may be rough that obtaining the final diagnosis actually comes as an (immediate) relief. However, later on in life many people encounter crisis and sorrow again, when new and unsuspected situations arise, and these conditions have to be recognized and dealt with. In most people with primary (congenital) immune deficiency the problems are worsened by suffering from a disease which is not at first observed or noticed by people around. That is why many patients feel that they encounter non-acceptance of their problems, for example by the health services, social services, and family and friends.

1. The family and the child (0 – 14 years)

The immune system of a child is not mature until the age of 4.5 – 5 years. That is why many parents are stressed by disease in a child in those first few years of life.

However, some severe immune deficiencies can already be diagnosed at birth.

A child with immune deficiency needs close attention from its parents. Although the child receive treatment, it is still highly susceptible to infections for example from other children in day care, nursery or at school. Ways are therefore generally sought of making care arrangements for the immune deficient child in places where it will be exposed to very few other children, minimizing the risk of infection.

Significantly, the immune deficient child is often infected by microbes which do not harm normal healthy people. Another feature of the immune deficient people is that they often tire quickly.

Periods of disease which are more frequent and last longer than in normal healthy children often compel the parents to stay at home to take care of their sick child. In addition, it may be necessary to keep the immune deficient child at home, in the event of disease in the child's usual institution/school.

If the child is receiving treatment with intravenous immunoglobulin, the parents have to take time off at regular intervals, every second or third week, to accompany the child to hospital for treatment. The treatment generally lasts 4 – 6 hours.

If the child is treated at home with subcutaneous administration of immunoglobulin, it is necessary for at least one of the parents to carry out the treatment, often once a week. The child needs peace and reassurance in the situation, and the treatment should therefore not be left to others.

Compensation to the family for loss of earning may be appropriate.

Increased expenses for children with immune deficiency, depending on the seriousness of the disease, may relate for example to medication, immunizations, expenses associated with hospital stays, transport to day care, education, treatment and leisure activities, courses on disabilities, aimed at parents and other family members, and expenses associated and with increased family accident insurance premiums.

Because of infections, the immune deficient child may often have many days of absence from school etc. this may lead to the child falling behind classmates and friends. And some educational support may be necessary.

Most parents of children with disabilities to differing extents at some time need respite from the daily routine. Provision of such respite can make it easier to keep the child at home.

Parents of an immune deficient child encounter many psychologically distressing situations, not just when the child receives its diagnosis, but also in situations when the child contracts a life-threatening infection.

2. Young people (14 – 18 years)
As an immune deficiency is a chronic life-long condition, young people have to carry on attending hospital for their treatment and check-ups. This fact, combined with inevitable periods of infections and the typical tiredness, often leads to absence from education and/or work.

The young people concerned must therefore be informed of and guided to possible educational support in relation to ongoing education and work.

Sexuality becomes very important in adolescence, and many people have their first experiences of love and sexuality at that time. For many young people it is difficult to discuss the thoughts and feelings they have about sexuality with their parents, and they therefore need to spend time together with other young people to swap thoughts and experiences.

If may be particular difficult to tell a boyfriend/girlfriend about the consequences of the disability.

Psychological support may be indicated, primarily talk therapy and dialogue on psychological problems secondary to a disability. This may be directly related to the handicap itself, acceptance of the disability and consequences in relation to other people.

Young patients with an immune deficiency may be in a situation, when they feel that their life is threatened in association with their disease. This may release a psychological crisis with an acute need of psychological support.

The transition towards coming of age is also a legislative matter. To make the transition as confidently as possible, one to two years before the young person reaches their 18th birthday, the family ought to receive advice on the future situation from the local authority in coordinated meetings with the participation of all who are involved in the care of the child/young person. In most cases the young person will have

to change social worker from the age of 18, because different rules have to be followed after that age. On this occasion the parents may receive clarification on the financial basis on which the young person is expected to manage.

3. Adults (18 – 65 years)
With increasing age a person's immune system becomes worn out. Adults therefore often experience more frequent infections, and common tiredness also increases.

Because of more frequent infections, adult patients often face higher expenses for medical care

Attention must still be paid to treatment and prevention, which may lead to absence from the working place.

Flexible employment or similar arrangements may be appropriate for adult patients.

It may be a good idea to draw up a written plan of action, in particular when support is often to 18-65 year old patients with a significant loss of functional capacity or more severe social problems.

The adult immune deficient patient may face severe types of increased expenses as a result of the disease.

It is not possible to make a complete list of these increased expenses which may be incurred in a specific case, but the following may be relevant:

- Expenses for transport, not reimbursed under other rules, e. g. transport for some treatment or in some cases to and from work/education.
- Expenses for medication not covered under other rules.
- Expenses in attending courses concerned with disabilities, e. g. travel, cost of registration on the course, materials, or care of non-participating children.

Psychological support may be necessary if adult patients feel their situation or life threatened by the disease.

4. The elderly (65+ years)
Suffering from an immune deficiency, together with growing older, implies particular problems.

The process of ageing begins earlier in person with primary immune deficiency than in the rest of the population. Physical skills decline faster. This may mean physical difficulties, such as rigidity, pains and tiredness. This is often caused by stain on the body due to use over a long time, which leads to wear and tear, noticeable from the age of 45 – 50. The physical disabilities also may lead to mental impairments, which in turn mean that the person has no energy to work or to participate in leisure activity. This results in isolation and passiveness.

The person concerned may therefore need advice, guidance and emotional support.

This may relate to:

- Understanding what changes are taking place in the body.
- Receiving instruction on how training can prevent future damage to the body.
- At retirement age people with immune deficiencies reach a transition, as at the age of 18, when a different set of rules becomes applicable in local authority provision.

To make the transition as easy as possible it is recommended that guidance should be provided situation in coordination meetings. The financial basis the elderly person is expected to manage on can be clarified. The transition to life as an old age pensioner signifies a change in social benefits, provisions and routines, which to date have been a part of everyday life.

Many older people with an immune deficiency find that their privileges and options are reduced when they reach retirement age. They may encounter a reduction in the allocation of assistance, despite increased need, as a number of compensatory social benefits are no longer applicable.

5. Parents with immune deficiency

When the disability is genetically determined and heritable, the person affected may need particular advice on prevention and fertility. Counselling may be given in genetics units.

Parents with a disability (particularly when it is not visible) often encounter problems in obtaining advice or other public services. This is due among other things to the fact that particular needs associated with the role of parent are not mentioned in the legislation as a particular basis for compensation.

A parent with an immune deficiency, after a specific evaluation, may be entitled to receive home help, for example, in order to cope with jobs in relation to children. If one parent is healthy, this is not necessarily an impediment to eligibility for assistance.

Useful tips on everyday life

The Swedish Primary Immunodeficiency Organization has published a small brochure entitled "How to make the immune system get better", from which we have taken the following practical tips:

For parents of a child with immune deficiency:

- Wash your hands often.
- Changes the bed linen often.
- Changes your clothes often.
- Clean the house often.
- Only buy small tubes of toothpaste. If there has been a recent infection, throw the old tube away.
- Change the tube if the child has been ill!
- Do not let the brothers and sisters share toothpaste with the immunodeficient child (streptococci might be transmitted through the toothpaste)
- Occasionally wash the toys in alcohol.
- Create routine and a friendly atmosphere around the treatment with medication (it is easier said than done – but try)
- Remember that the attitude of the parents to a hospital visit is conveyed to the child.

For adults with an immune deficiency:

- Wash your hands often.
- Do not shake hands unnecessary with others – especially not at times when colds are going around.
- Remember that public telephones and money are full of bacteria.
- Drink sufficient amounts of liquid. This will help the mucous membranes in the fight against infection. But do not drink liquid which is too cold or warm, which may irritate the mucous membranes.
- Rinse your nose regularly with physiological saline, which is available from pharmacies. This could rinse away many bacteria in the mucous membranes.
- Eat a balanced diet, rich in vitamins.
- Get fresh air and exercise.
- If you have mucus in the lungs a physiotherapist can help you learn the technique of loosening the mucus, including the use of a PEP mask.
- Air the room. This is especially important in workplaces with a lot of people.
- When going to public toilets, keep the paper tissue you used to dry your hands and grip the handle with the paper tissue.
- Use gloves in autumn and winter when travelling on public transport. There are many sources of infection on handles and banisters.
- Listen to your body. It will talk if you bother to listen. Find out by trial and error what is good for you.
- Make contact with other immune deficiency patients. They know what you are talking about, and there is no need for many explanations.
- Learn about your disease. It is easier when you understand how the immune apparatus works and when you know what you can do yourself to improve your condition.

Two other useful tips for children as well as adults:

- Eat vitamins at the recommended dose. It is effective especially if you have blisters in your mouth.
- Use a mild toothpaste.

Questions

1. A pair of parents has a predisposition to a disease with autosomal recessive inheritance. How great is the risk of having a sick child?

a. 25 per cent

b. 50 per cent

c. 100 per cent

2. A pair of parents has a predisposition to a disease with autosomal dominant inheritance. How great is the risk of having a sick child?

a. 25 per cent

b. 50 per cent

c. 100 per cent

3. A pair of parents has a predisposition to a disease with autosomal recessive inheritance. How great is the risk of having a sick child?

a. 25 per cent

b. 50 per cent

c. 100 per cent

4. The sick child of parents with inheritance as described in question 3 will be a:

a. Boy

b. girl

5. Which vaccines are live?

a. MMR.

b. Diphtheria

c. Tetanus

d. BCG

e. Hepatitis B

6. In which of the following diseases is the pneumococcal vaccine indicated?

a. Absence of normal spleen function

b. Asthma

c. History of invasive pneumococcal infection (septicaemia /meningitis)

d. SCID and agammaglobulinaemia

Notes:

- Although all care has been taken, this booklet is a general guide only which is not intended to be a substitute for individual medical advice/treatment. Allergy and Immunology Awareness Program in Qatar expressly disclaim all responsibility (including negligence) for any loss, damage or personal injury resulting from reliance on the information contained.
- We would like to thank Hans Ole Christensen and Sven Fandrup for giving us permission to include their patient education booklet in our product.

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