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MEASLES

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There is no doubt that measles causes more suffering, malnutrition and death in the developing world than any other illness due to a single well-defined entity Practically all children get measles. In 1875 when measles was first introduced to the isolated virgin community of Fiji over 90 per cent of the population were affected. Before vaccine was available around 15 per cent of the children in Europe and probably over 20 per cent in the developing countries apparently escaped the disease. The majority of these were in contact with the disease in the early months of life and underwent a sub-clinical infection.

Historically, in the past measles was a major cause of infant morbidity and mortality in all countries Epidemics in Glasgow in the first decade of this century showed a case fatality rate of 5 per cent. In Europe in the nineteenth century measles had a prominent place as a major cause of death. In the developed world there has been a remarkable decline in mortality in the last few decades. The decline preceded and seems to have been little influenced by the introduction of antibiotics It is attributed to the cumulative effect of the increased standard of living and the greater access to medical care In addition, in the last decade, the live measles vaccine has proved its value and efficacy in the temperate industrialized countries.

In contrast measles is still a major cause of death in the majority of the developing countries Community studies reported case fatality rates of 7 per cent. in Nigeria and 1.5 per cent in India as compared with 0 02 per cent in England Respiratory complications are relatively common to all countries, but diarrhoea is also important in the tropics and is in many instances the cause of death Measles keratoconjunctivitis is associated with xerophthalmia as the commonest cause of blindness in many African and Asian countries.

There is now reasonable laboratory and epidemiological evidence that only a single strain of measles virus exists, and the greater severity of the disease cannot be attributed to a difference in the virus. In the United States of America, with its mixed population, measles is not significantly different in different ethnic groups, suggesting that inherited immunity is not important.

The significant differencesbetween measles in developing and industrialized countries are attributed to

1. Beliefs and attitudes to measles and its management

In Africa the diet and even the fluid intake of children are restricted during and immediately after the disease. The parents are likely to refuse to allow the child to have an injection. In Asia measles is thought to be due to a goddess, called Matta in India, and the parents of a child with measles will conceal the child at the back of their hut and doctors working in rural India may not see the disease except occasionally. In South America, many of

the old beliefs from Europe exist, and there are reports of children being beaten with nettles to bring out the rash. These are but few examples - failure to know and understand these attitudes limits effective care and increases the severity of the disease.

2. Age at onset

Unlike Europe and North America where many children do not catch measles until they reach school age, the majority of children in tropical and developing countries are infected within the first three years of life This may be in part due to the extended family, which allows much greater opportunity for young children to be in contact with each other, and to children being carried around by their mothers, thus offering many opportunities for the spread of a droplet infection Recent observations suggest the possibility that malnourished children continue to excrete the virus for a period after the appearance of the rash This protracted infectivity possibly contributes to the earlier age incidence where malnutrition is prevalent

3. Malnutrition

Most deaths from measles in tropical countries occur in the second year of life, i.e. the age of maximum prevalence of protein energy malnutrition. The synergistic detrimental effect of the two disorders is important, for both contribute to impaired cellular immunity. It has been said that a community is malnourished so long as the children die of measles. It has long been known that a dark red-purple rash with heavy desquamation is associated with serious disease Rhazes in his original classic description of measles in AD 850, wrote "Measles which are of a deep red violet colour are of a bad and fatal kind". Equivalent changes to those in the skin may give rise to many of the so-called 'complications' of measles when they occur on other epithelial surfaces

On the other hand in children with a border-line nutritional status, measles can precipitate clinical malnutrition In a study in Nigeria, 25 per cent of the children lost more than 10 per cent of their former weight as the result of this infection. Such a weight loss is serious in children, who should be gaining weight regularly and who were on a barely adequate diet The children did not recover this weight quickly the average time taken was seven weeks, and 15 per cent of the children took more than three months Among children with diarrhoea, the time taken to recover weight loss was almost twice as long. Measles entropathy is associated with the loss of 20 per cent of the dietary protein intake Measles precipitates more kwashiorkor than any other disease of childhood

Control of measles

The severity of measles and its mortality can be reduced either by improving the nutrition of all the children or by measles vaccination Improving the nutrition to the level at which measles is only a mild disease must be a slow process, involving education of the whole community

The alternative, vaccinating children against measles involves little behavioural changes and is more easily accepted By this immunization process the nutrition of the children will be improved as measles itself precipitates malnutrition Measles-vaccinated children have been shown to gain more weight in the subsequent months than unprotected controls

Measles vaccine

A safe and highly potent live measles vaccine was developed 12 years ago which has made possible the effective control of measles. The live attenuated measles vaccine commonly in use at present is prepared in chick embryo cell culture The current vaccine virus strain has been attenuated beyond that of the original Edmonston B strain Measles vaccine produces a mild or inapparent, non-communicable infection.

One dose of the vaccine is enough provided it is not given too early in life (see below). The minimum human dose of the commercially available further-attenuated live measles vaccine is 10^3 $TCID_{50}$. No reinforcing doses are required. The subcutaneous route using sterile disposable syringes and needles, or jet injectors, is recommended for administration of the vaccine. Where re-usable syringes and needles are used, care should be taken when sterilizing by boiling to ensure that the syringes and needles are dried thoroughly and are free of detergent or disinfectant The use of jet injectors raises special problems of disinfection and handling and usually causes a loss of vaccine varying from 25 to 30 per cent.

The optimal age for vaccination in the developing world has been a subject of controversy, considering the very young age of incidence. One of the important obstacles to effective vaccination in these countries is the relatively short duration of measles susceptibility and hence measles vaccine responsiveness. Nearly all newborn children have maternally derived passive protection against measles but it gradually wanes and about 90 per cent of children have their maternal antibodies (as detected by haemagglutination inhibition) at the age of 7 - 8 months. At the same time it is precisely at this point that the incidence of measles begins to rise sharply. Operationally the best compromise for vaccination would seem to be 9 - 15 months of age Even then a substantial proportion of children will have contracted measles while a small proportion will still be protected by maternal antibodies. However, if a high percentage of children (i.e. approaching 90 per cent) in the age-group 9 - 15 months are vaccinated and the programme is continued for some time this would have the effect of reducing the percentage of children who contract measles before the age of 15 months and thus gradually increase the efficacy of routine vaccination of children 9 - 15 months of age. A continuing programme has to be maintained indefinitely. Failure to do so would rapidly result in a return to the current high prevalence of measles in young children.

Measles antibodies develop in over 90 per cent of susceptible children vaccinated in the age-group 9 - 15 months. The titres of the vaccine-induced antibodies are lower than those following natural disease, but the conferred protection appears to be durable judging from evidence extending now to a 14-year follow-up

Live measles vaccine has an excellent record of safety Adverse reactions temporally associated with measles vaccination, those of the central nervous system including encephalitis and encephalopathy, reportedly occur approximately once every million doses.

Fifteen per cent of vaccinated children have fever beginning about the sixth day after vaccination and lasting up to 5 days Transient, atypical rashes have rarely been described. Most reports indicate that children with fever are otherwise asymptomatic.

In a community-wide immunization programme there is no absolute contra-indication to vaccination. However, some precautions should be taken In the case of severe febrile illness it is advisable to postpone vaccination until after complete recovery. Where there is known active tuberculosis the patient should be under treatment when vaccinated. Recent administration of immunoglobulins requires postponement of vaccination for three to four months

The only contra-indications in childhood immunization programmes are altered immune states such as those present in leukaemia and other malignant conditions or those receiving induced immune-suppressive therapy

The vaccine is lyopholized and usually packed with the diluent. In the lyopholized form the vaccine can be stored at 4-8°C but it is preferable to have it stored at below zero degrees. The diluted vaccine loses its potency rapidly (when reconstituting the vaccine care should be taken that the diluent is cold) in 2 hours at 37°C the potency decreases from 1000 to lower than 100 $TCID_{50}$, so what is not used within an hour of reconstitution should be discarded. Furthermore measles vaccine is very sensitive to light and should be protected against direct daylight

Failures of measles vaccination programmes are usually due to either inadequate conditions of storage or handling of the fragile vaccine, to giving the vaccine to the wrong age-group, or to a low coverage of the target population

The vaccine can be combined with other vaccines in multiple antigen programmes