

# Virology

## and the General Practitioner

by Prof BD Schoub

**V**irology, as a discipline, should be of paramount importance in family medicine as viruses are responsible for at least half, if not more, of all cases seen by the average practising general practitioner.

However, as a branch of laboratory medicine it is the least utilized both by the specialist and the general practitioner alike.

As a branch of medical science it is relegated to some long forgotten compartment of the third year medical curriculum.

This state of affairs is to a large extent the result of the belief that viral diseases are not amenable to any form of specific management, that they are in the main diagnosable solely on clinical grounds and that laboratory investigation is cumbersome, expensive and takes too long to be of any meaningful use to the patient.

It is thus little wonder that the label "it is due to a virus" is applied when a practitioner is stumped for a diagnosis and the patient needs reassurance.

With the dramatic progress in biomedical science and especially in branches such as virology, it is to be expected that the recognition and the management of viral diseases will soon become a major part of clinical practice.

It is thus essential that the modern general practitioner understands exactly what a virus is, how it produces disease and how it spreads, so that this substantial bulk of his patient load is scientifically and rationally managed.

### What is a virus?

Viruses have for some time been of tremendous interest to a variety of basic biological scientists as they straddle a grey frontier between living things and chemical matter.

Their simplicity, size and crystalline structure are characteristics of non-living chemicals whereas their ability to replicate and their possession of hereditary characteristics are features of living agents.

Essentially, the virus consists of a relatively small amount of nucleic acid (DNA or RNA) which is the repository of its limited genetic material, a characteristic protein shell to protect the nucleic acid and, in some viruses, a delicate lipoprotein envelope.

With its simplicity and limited amount of genetic material the virus does not, itself, have the machinery to replicate.

By nature, therefore, it requires to parasitise a living cell and hijack the latter's metabolic apparatus to xerox off copies of itself.

Consequently, by definition, all viruses are infectious. While many viruses may merely exist as "passenger viruses" ie not causing any obvious harm to the host organism, other viruses may damage cells during their replicative process and thus produce disease.

### How do viruses produce disease?

Virus replication, by causing damage in cells from critical organs, may directly produce disease or

death. Alternatively, the host's immune response directed against the foreign protein of the virus may indirectly produce disease.

Similarly, viral damage of cells in the circulatory system may indirectly produce disease via secondary vascular effects such as ischaemia or haemorrhage.

While many viruses damage and destroy cells during their replication other viruses may replicate in harmony with the replication process of the cell, thus producing no obvious damage to its host. Such infections are frequently referred to as latent infections.

The herpes group of viruses are characterised by alternate stages of acute infection producing clinical manifestations and latent infection where the virus remains silent, only to be re-activated at a later stage, again producing clinical manifestations.

With other viruses, integration of the genetic material of the virus with that of a host cell may take place leading to alteration of the characteristics of the cell which may result in malignant transformation. Some virus infections are characterised by very slow replication of the virus in the host cell, the so-called "slow virus diseases" and this has been postulated to be a possible mechanism by which some viruses may produce chronic degenerative diseases of man.

Viruses enter the body by three main portals of entry, viz: the respiratory tract, the gastrointestinal tract and the integumentary system

including the mucous membranes and the eye.

They may remain restricted to these sites producing localised infections or, alternatively, the virus may merely utilise these portals of entry to gain access to the body as a whole, producing generalised infections.

In the case of the generalised infections a series of multiplication steps occur in the body to amplify the amount of virus to the extent where it can produce disease.

These multiplication steps occur successively in the draining lymph nodes, the blood stream, a variety of sinusoidal organs, back again into the blood stream and then eventually seeding out to the appropriate specific target organs.

Substantial multiplication of virus takes place in the sinusoidal organs and when virus, together with necrotic cell debris, spill out into the blood stream this produces non-specific clinical signs which characterise the prodrome of a variety of generalised viral infections.

The stage prior to the prodrome, from the time the virus enters the body until the first clinical manifestation, is referred to as the incubation period, and because of the complicated series of multiplication steps, the incubation period of generalised viral infections tends to be fairly long, usually varying from one and three weeks.

Because of this, extensive multiplication of the virus in the body is a very powerful stimulus of the immune system producing permanent solid immunity. This, combined with the fact that the viruses which cause generalised infections are usually of only one antigenic type (serotype) is the reason why the infections due to viruses such as measles, rubella, mumps, etc are followed by a life-long immunity.

In contrast to this, the localised infections present a far lesser immunological stimulus, are followed by a much weaker immunity and are usually caused by viruses of many serotypes.

It is therefore little wonder that individuals may have any number of colds or upper respiratory tract infections within relatively short periods of time.

### How do viruses spread?

Yes, viruses do indeed "go

around" but they do so following scientific principles. Viruses which are not surrounded by an envelope are generally robust and stable and are able to survive for relatively long periods of time outside the body.

They can therefore be spread in food, milk, water and other inanimate objects.

Examples of such viruses are the enteroviruses such as poliovirus and the hepatitis viruses.

In contrast, the enveloped viruses are labile, cannot survive for long outside the body and therefore must be spread directly from individual to individual, often by respiratory droplets.

Examples of such viruses are those producing respiratory tract infections, which tend to be more common during the winter months when individuals are generally in close contact with each other, and also the viruses producing the acute generalised infections of childhood, such as measles, varicella, mumps and rubella, which tend to be more common during the spring. Enterovirus infections on the other hand are more common during summer.

### Application of general principles to specific diseases

Bearing in mind the above basic principles, the development, presentation and management of viral

diseases may be placed on a more rational and scientific foundation.

The frequency and recurrence of upper respiratory tract infections becomes easily understandable.

In the case of influenza, special conditions apply owing to the genetic instability of the virus. As a result of this instability, the outermost protein "spikes", namely the haemagglutinin (H) and the neuraminidase (N), periodically undergo a change in their chemical composition and therefore in their antigenic specificity.

As a result of this, no sooner has the community built up a resistance to a particular strain or strains of influenza viruses, then they undergo a modification to their H and N antigens producing a new strain of virus to which the individual becomes susceptible again.

This change occurs every couple of years producing a fresh epidemic of influenza and it therefore becomes mandatory to up-date the influenza vaccine to include the current circulating strain.

Viral gastroenteritis or gastric flu is a common complaint seen in the general practitioner's consulting room. While in an older child and adult this disease is merely of nuisance value, in a young infant it may produce severe and often life-threatening disease.

The infection is a localised one

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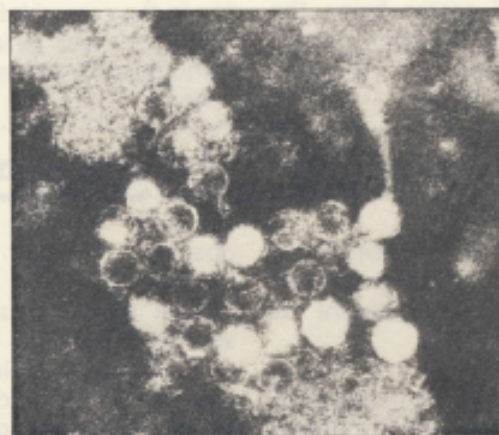


Fig. 1. Small round virus particles of the Norwalk-type which are responsible for the very common viral diarrhoeal and vomiting disease seen in older children and adults. Electron micrograph of stool suspension magnified approximately 1000 00 X.

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produced in the main by a virus called rotavirus and should be treated purely symptomatically, ie energetic replacement of fluid and electrolytes.

Smooth muscle antagonists are absolutely contra-indicated as motility is one of the major defence mechanisms of the gastrointestinal tract.

Similarly contra-indicated are antibiotics which may aggravate and perpetuate the diarrhoea by altering the intestinal flora and possibly also producing resistant bacteria.

The herpes group of viruses, as mentioned above, are characterised by a primary infection followed by a latent, silent infection and periodic recurrent reactivation at later stages in life.

For example, herpes simplex infection usually presents itself to the general practitioner as the common, distressing complaint of recurrent "fever" blisters.

The fact that the virus is latent in the nerve ganglia supplying that area makes eradication of the disease impossible, although one can reassure patients that in many cases the recurrences do spontaneously disappear.

In some cases the individual attacks may be aborted by liberal application of antiviral ointments and creams to the area, provided that it is done at an early stage, ie before the development of vesicles.

Another example of primary and reactivation disease in the herpes group of viruses is seen with varicella and zoster (shingles), varicella being the primary and zoster being the reactivation manifestations respectively, of infection with varicella-zoster virus.

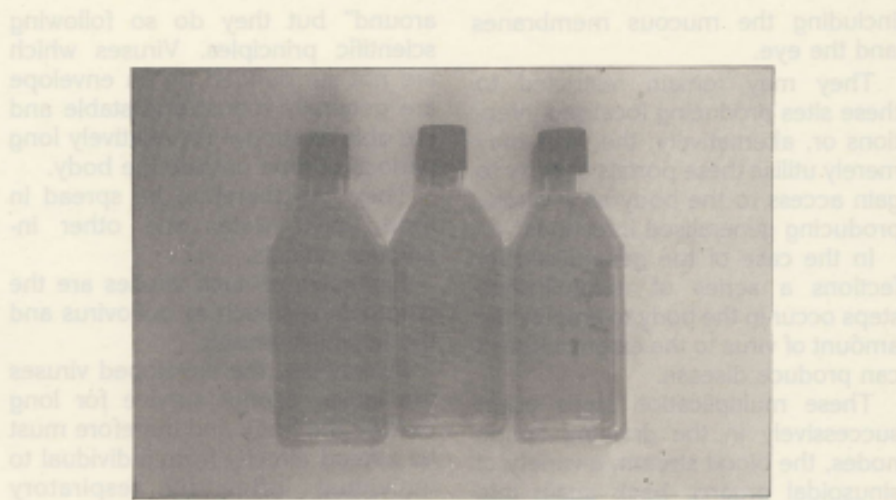


Fig. 2. Discrete round viral plaques seen in flasks containing monkey kidney cell cultures injected with polio virus.

It should therefore be of little surprise that when Grandpa develops his shingles this may set off an outbreak of chickenpox in the family.

Virus hepatitis is a disease characterised by a particularly long incubation period. In the case of infectious hepatitis due to hepatitis A virus, the incubation period varies usually from 15 - 35 days, whereas in serum hepatitis due to hepatitis B virus the incubation period is usually between two and six months.

Because of these long incubation periods the disease may be prevented in individuals who have been exposed to the virus, by the application of pre-formed antibodies.

This so-called passive immunization in the case of infectious hepatitis is carried out using pooled immunoglobulin taken from random donors.

In the case of serum hepatitis, passive immunization is done using hyper-immune globulin taken from convalescent patients with particularly high antibody titres.

Pooled immunoglobulin, especially the local South African product, has sufficiently high antibody levels to be effective against hepatitis A virus. This is not so with viruses such as hepatitis B, varicella, rabies, measles and rubella, for which hyperimmune globulins prepared from convalescent or immunized subjects, are used for passive immunization.

Passive immunization is most effective when given as early as possible and is of little use if administered ten days to two weeks after exposure. Because the antibodies are degraded in the blood stream, immunization is effective only for a relatively short period of time, varying from one to three months. □

## Insulin dosage errors solved

Dosage errors due to dead space in syringes is one of the major problems in the management of diabetes.

In a study of dead space and its effect on insulin mixing, M Rosoff et al (1975), found that dosage error due to dead space was as high as 46% when preparing a typical dose of mixed insulins, and as high as 60% when preparing the smaller total

dosage common to paediatric therapy.

With the introduction of a new strength insulin in South Africa, it was necessary to introduce a new type of syringe which eliminates the potential hazards of dosage error caused by dead space. These syringes, the B-D 0,5 cc and 1 cc, are manufactured by Becton Dickinson, a company which specialises in diabetic patient care products, and

marketed in South Africa by AHSC/South Africa Pty Ltd.

Unlike other syringes, B-D 0,5 cc and 1 cc syringes have a clear single scale to improve dosage accuracy.

The need for accuracy must however be balanced with the need for legibility. G-D 1 cc syringes are, therefore, marked with two unit increments and the 0,5 cc syringes are marked in single units.