RECOGNITION AND MANAGEMENT OF VIRAL HAEMORRHAGIC FEVERS

A handbook and resource directory

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IN EMERGENCY

Use the table of contents to refer directly to the subject on which you require information

or telephone:

Dr R Swanepoel or alternate at 011-640 5031
(after hours: Telecall 011-339 5674 and leave message for “25058”)
for general information on viral haemorrhagic fevers
or information on laboratory diagnosis

or

Dr G B Miller or alternate at 011-640 5081
for information on patient care, barrier-nursing
or transfer of patients.
CONTENTS

1 INTRODUCTION ........................................................................................................ A1

2 CLASSIFICATION OF HAEMORRHAGIC FEVER VIRUSES:
2.1 Taxonomic classification .................................................................................................B1
2.2 Classification according to primary transmission B2

3 CRITERIA FOR PROVISIONAL DIAGNOSIS OF VHF:
3.1 Early signs and symptoms of VHF ................................................................................. C1
3.2 Further information on VHF .......................................................................................... C1
3.3 Making a preliminary decision ....................................................................................... C1
3.4 Initial assessment of patient status ................................................................................. C2
3.5 Immediate course of action ............................................................................................ C2

4 VERIFICATION OF DIAGNOSIS:
4.1 Systematic consideration of differential diagnoses ........................................................... D1
4.2 Laboratory tests to exclude non-VHF diseases .............................................................. D2
4.3 Submission of specimens for virological examination:
4.3.1 Source and nature of specimens:
4.3.1.1 Specimens recalled from clinical laboratories ............................................................ D4
4.3.1.2 Specimens from live patients .................................................................................... D4
4.3.1.3 Specimens from corpses ......................................................................................... D4
4.3.2. Packaging of specimens ............................................................................................ D4
4.3.3 Information to accompany specimens ......................................................................... D5
4.3.4 Transmission of specimens ....................................................................................... D11
4.3.5 Examination of specimens and reporting of results ..................................................... D12

5 ISOLATION AND HIGH SECURITY BARRIER-NURSING OF VHF PATIENTS:
5.1 Introduction.................................................................................................................... E1
5.2 Administrative requirements............................................................................................. E1
5.3 Facilities ......................................................................................................................... E1
5.4 Equipment and supplies................................................................................................. E2
5.4.1 Equipment in the isolation room.................................................................................... E2
5.4.2 Supplies required outside the isolation room.............................................................. E3
5.4.3 Safety equipment ........................................................................................................ E4
5.5 Personnel ........................................................................................................................ E4
5.6 Placing a patient into isolation........................................................................................ E5
5.7 Dressing for entering the isolation room......................................................................... E6
5.8 Procedure for leaving the isolation room ........................................................................ E7
5.9 Disinfectants ................................................................................................................ E8
5.9.1 Halogens ..................................................................................................................... E8
5.9.2 Aldehydes .................................................................................................................. E10
5.9.3 Phenols and related compounds ................................................................................. E11
5.9.5 Summary of disinfectants and their applications .........................................................E12

- 2 -

5.10 Decontamination and disposal of hazardous items .....................................................E13
5.11 Disposal of corpses ......................................................................................................E14
5.12 Discharge of patients .................................................................................................E16

6 REFERRAL OF PATIENTS:
6.1 Indications for transfer of patients .............................................................................F1
6.2 Contra-indications to transfer of patients .................................................................F1
6.3 Requirements at VHF regional centres .......................................................................F3
6.4 Designated secondary hospitals for VHF referrals ......................................................F6
6.5 Reaching a decision on transfer of patients ..................................................................F12
6.6 Transport of patients ..................................................................................................F14

7 TREATMENT AND MONITORING OF PATIENTS:
7.1 Supportive treatment .................................................................................................G1
7.2 Immune plasma and antiviral therapy .......................................................................G3
7.3 Clinical laboratory monitoring of patients ...................................................................G4
7.3.4 Monitoring of laboratory staff ..............................................................................G5

8 ADMINISTRATIVE CONSIDERATIONS:
8.1 Responsibilities, Regional Director of N Health & Pop Dev .......................................H1
8.2 Initiation and structure of a Regional VHF Committee ................................................H2
8.3 Functions of the Regional VHF Committee ...............................................................H2
8.4 Role of Regional VHF Committee in forward planning ...............................................H3
8.5 Role of Regional VHF Committee in controlling outbreaks of VHF .........................H4
8.6 Communication with the media ..................................................................................H5
8.7 Conclusion ..................................................................................................................H6

9 NOTIFICATION OF VHF AND OBSERVATION OF CONTACTS:
9.1 Notification ................................................................................................................I1
9.2 Tracing and classification of contacts:
9.2.1 Aim ......................................................................................................................I3
9.2.2 Responsibility .......................................................................................................I3
9.2.3 Definitions ...........................................................................................................I3
9.3 Observation ................................................................................................................I5

10 NOTES ON SAFETY EQUIPMENT:
10.1 Protection of individual staff members ......................................................................J1
10.2 Patient isolators: bed and transport ........................................................................J1
10.3 Laboratory isolators .................................................................................................J2

11.1 LASSA FEVER .........................................................................................................K1
11.2 ARGENTINIAN AND BOLIVIAN HAEMORRHAGIC FEVERS ......................L1
11.3 MARBURG VIRUS DISEASE ..............................................................M1
11.4 EBOLA VIRUS DISEASE ..................................................................N1
11.5 RIFT VALLEY FEVER .....................................................................O1
11.6 CRIMEAN-CONGO HAEMORRHAGIC FEVER ...............................P1
11.7 HAEMORRHAGIC FEVER WITH RENAL SYNDROME ....................Q1
11.8 YELLOW FEVER ............................................................................R1
11.9 DENGUE .......................................................................................R1
11.10 CHIKUNGUNYA ............................................................................R1
11.11 OMSK HAEMORRHAGIC FEVER AND KYASANUR FOREST DISEASE R1
12 SELECTED BIBLIOGRAPHY ...............................................................S1
1. INTRODUCTION

Many pathogenic micro-organisms, even opportunistic pathogens, can cause haemorrhagic fever under particular circumstances. Common infections such as measles sometimes run a haemorrhagic course and poisons, toxins and drug sensitivities can produce similar disease presentation.

However, it is important to distinguish these conditions from haemorrhagic fevers caused by the so-called formidable or class 4 viruses. These viruses have in common a marked propensity for person-to-person spread and high mortality rates, properties which render them liable for control by the State: the designation class 4 denotes that the viruses may only be acquired, kept and cultured at maximum security laboratories which meet BL4 (biosafety containment level 4) criteria and which are specifically empowered in terms of schedules disease regulations to perform these functions. As made clear elsewhere in this document, other laboratories inevitably receive specimens from haemorrhagic fever patients for haematological, chemical pathology, bacteriological and other tests, but only designated BL4 laboratories may specifically undertake culture of specimens for class 4 viruses, or archival storage of material known to be infected with these viruses.

The concept of maximum security laboratories arose in the United States of America in 1969 when fatal laboratory infection occurred during the original investigation of Lassa fever. There are only five such laboratories in the western world, including one in South Africa, and even the largest nations have only one diagnostic centre each. The stimulus for the Department of National Health and Population Development to build a BL4 laboratory in South Africa came from an outbreak of Marburg disease in Johannesburg in 1975. Infection is thought to have arisen in Zimbabwe. The South African BL4 laboratory is operated by the Special Pathogens Unit at the National Institute for Virology in Sandringham, Johannesburg, as a diagnostic and investigative centre for our region.

The Department of National Health and Population Development also operates a facility for isolation and barrier-nursing of viral haemorrhagic fever patients at Rietfontein Hospital in Johannesburg and has provided transport isolators for moving patients. It was anticipated that this service would cater largely for imported cases of viral haemorrhagic fever, i.e. patients who gain infection outside South Africa. However, it has become clear that viral haemorrhagic fever is an indigenous problem and that affected patients are inevitably encountered and nursed in hospitals run by provincial and other administrations. Moreover, it is not always possible or desirable to move such patients to a distant facility. Apart from the fact that there are often contra-indications to the movement of patients by the time that viral haemorrhagic fever is recognized, the sheer numbers involved render it impractical to transfer all patients to a central facility.
During 1986, specimens were received at the National Institute for Virology from 258 suspected cases of viral haemorrhagic fever, an average of one case every 1.4 days. (It makes little difference that only 19 of the patients proved to be suffering from infection with a class 4 virus.) The patients were associated with at least 77 hospitals throughout the country. In addition, hundreds of contacts of these patients were placed under observation, some under conditions of quarantine in hospitals.

The conclusion is inescapable: suspected and genuine cases of VHF will continue to occur in hospitals throughout the country and if tragedies are to be avoided, there must be wider provision for dealing with VHF. In practice, this means that there should be increased awareness and contingency planning in all hospitals and specific provision for dealing with viral haemorrhagic fever at conveniently-located regional centres throughout the country. There has been progress in this direction, but minor problems remain to be resolved before adequate arrangements can be said to exist in all parts of the country.

Class 4 viral haemorrhagic fevers occur in many countries and modern communications make it possible for introduced cases to occur virtually anywhere in the world. This memorandum is concerned mainly with the indigenous African viral haemorrhagic fevers and it is intended merely as a guide to recognition and handling of suspected cases. The recommendations are not binding except where reference is made to legislation or statutory regulations, or where there is reference to agreed protocol for dealings between separate organisations and institutions. In other words, each organisation or institution, from Government departments to individual hospitals, may implement their own detailed internal protocols, arrangements, duty rosters or training programmes.
### 2. CLASSIFICATION OF HAEMORRHAGIC FEVER VIRUSES

2.1 The taxonomic classification of viruses which have a particular association with haemorrhagic fever is as follows:

#### Biohazard

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
<th>Virus</th>
<th>Distribution</th>
<th>Biohazard Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arenaviridae</td>
<td>Arenavirus</td>
<td>Lassa fever*</td>
<td>W. Africa</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Junin</td>
<td>S. America</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Machupo</td>
<td>S. America</td>
<td>4</td>
</tr>
<tr>
<td>Filoviridae</td>
<td>Filovirus (proposed)</td>
<td>Marburg</td>
<td>E. &amp; southern Africa</td>
<td>4</td>
</tr>
<tr>
<td>Bunyaviridae</td>
<td>Phlebovirus</td>
<td>Ebola</td>
<td>C. &amp; E. Africa</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Nairovirus</td>
<td>Rift Valley fever</td>
<td>Africa</td>
<td>3**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crimean-Congo haemorrhagic fever</td>
<td>E. Europe, Asia</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Hantavirus</td>
<td>Hantaan*</td>
<td>World-wide</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(proposed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Togaviridae</td>
<td>Alphavirus</td>
<td>Chikungunya***</td>
<td>Africa, Asia</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Flavirus</td>
<td>Yellow fever</td>
<td>W. Africa &amp; S. America</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dengue I, II, III, IV</td>
<td>Caribbean, Asia, E. &amp; W. Africa</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Omsk haemorrhagic fever</td>
<td>Siberia</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kyasanur forest disease</td>
<td>India, Pakistan</td>
<td>4</td>
</tr>
</tbody>
</table>

* Lassa fever and Hantaan viruses are actually groups or 'complexes' of viruses.

** Rift Valley fever virus is placed in class 4 outside Africa.

*** The haemorrhagic form of chikungunya infection has been reported only in Asia.
2.2 Classification of African haemorrhagic fevers according to primary transmission and reservoir hosts.

### Primary transmission

<table>
<thead>
<tr>
<th>Virus Complex</th>
<th>Vectors</th>
<th>Other</th>
<th>Reservoir hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lassa fever complex</td>
<td>-</td>
<td>Zoonosis</td>
<td>Rodents</td>
</tr>
<tr>
<td>Hantaan complex*</td>
<td>-</td>
<td>Zoonosis</td>
<td>Rodents</td>
</tr>
<tr>
<td>Yellow fever</td>
<td>Mosquitoes</td>
<td>-</td>
<td>Man (monkeys)</td>
</tr>
<tr>
<td>Dengue fever*</td>
<td>Mosquitoes</td>
<td>-</td>
<td>Man</td>
</tr>
<tr>
<td>Chikungunya**</td>
<td>Mosquitoes</td>
<td>-</td>
<td>Primates</td>
</tr>
<tr>
<td>Rift Valley fever***</td>
<td>Mosquitoes</td>
<td>Zoonosis</td>
<td>Sheep and cattle</td>
</tr>
<tr>
<td>Crimean-Congo haem. fever</td>
<td>Ticks</td>
<td>Zoonosis</td>
<td>Small mammals, livestock</td>
</tr>
<tr>
<td>Ebola</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Marburg****Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

*Haemorrhagic fever associated with Hantaan complex or dengue fever viruses has not yet been described in Africa.

**Chikungunya has only been associated with haemorrhagic fever in Asia.

***Rift Valley fever is usually a zoonosis in southern Africa, associated with contact with sick livestock or animal tissues, i.e. mosquito transmission to man is rare in southern Africa.

****Marburg disease was a zoonosis associated with monkeys in the first recorded outbreak, but there is no evidence that monkeys are ordinarily reservoir hosts.
3. CRITERIA FOR PROVISIONAL DIAGNOSIS OF VIRAL HAEMORRHAGIC FEVER (VHF)

3.1 The early signs and symptoms of VHF are non-specific: fever, headache and myalgia. Suspicion should be aroused by:-

3.1.1 Additional signs and symptoms such as pharyngitis, conjunctivitis, vomiting, diarrhoea, abdominal pain, haemorrhagic manifestations or shock, jaundice or laboratory evidence of an incipient haemorrhagic state or liver failure.

3.1.2 Short duration and rapid progression of the disease (acute rather than chronic illness).

3.1.3 Lack of evidence in the patient's history or physical examination which excludes VHF.

3.1.4 Lack of evidence from laboratory tests already performed which would tend to exclude VHF, e.g. positive bacteriological blood cultures, neutrophilia suggesting bacterial infection, normal platelet and leukocyte counts.

3.1.5 A history during the three weeks prior to onset of illness of:

3.1.5.1 contact with a case of VHF

3.1.5.2 residing in or visiting a tropical or rural environment

3.1.5.3 contact with animals or their tissues

3.1.5.4 handling or being bitten by ticks or insects

3.1.5.5 travel to an area or country known or considered likely to be endemic for VHF (particularly if the journey combines the ingredients of rural environment and contact with animals or insects).

Cases which present with the features outlined in sections 3.1.1, 3.1.2, 3.1.3 and 3.1.4 and which meet any of the criteria in section 3.1.5, can be diagnosed provisionally as VHF.

Note: infection with rodent-associated VHF viruses (see 2.2) can occur in an urban situation.

3.2 It may be of help to read the descriptions of the VHF s in Section 11, or more detailed published accounts of these diseases.

3.3 A preliminary decision should be reached in consultation with, or immediately made known to, those in authority at the hospital concerned. (The hospital where a case of
VHF is first suspected or diagnosed, is designated the primary hospital. There may be pre-existing arrangements at the hospital for convening a panel to make an initial assessment of suspected cases of VHF, or alternatively, outside opinion and advice may be sought (see 6.4.1, 6.5.1, 6.5.2 and 9.1.2). Clinicians dealing with a private patient in a surgery, have the same recourse to outside assistance.

3.4 The outcome of initial assessment is likely to be inconclusive, but the two aims should be:-

3.4.1 To reach a decision as to whether or not to proceed on the assumption that VHF may be involved. The inordinate inconvenience which can be caused by false alarms should be balanced against the potentially dire consequences of failure to recognize VHF.

3.4.2 To categorize the case as one involving either low, moderate or high risk.

Low risk patients have febrile disease with features suggestive of VHF, but are not necessarily severely ill and lack a history of contact with known VHF, have not had contact with animals (other than long-term pets), or animal tissues, or animal parasites (ticks) and have not left an urban environment for at least three weeks prior to onset of illness.

Moderate risk patients have febrile disease with features suggestive of VHF, are not necessarily severely ill, but have visited or resided in a tropical or rural environment, or have had contact with animals or animal tissues, or animal parasites (ticks) during the three weeks preceding onset of illness. They have not had direct or indirect contact (see 9.2.3) with known VHF patients, but may have some remote association with such patients, e.g. they have worked, resided in or visited the same places as patients who developed VHF.

High risk patients are severely ill with fever and haemorrhagic manifestations (this criterion is sufficient to place patients in the high risk category). In addition, they may have visited or resided in a tropical or rural environment, or have had contact with animals, animal tissues or animal parasites (ticks) during the three weeks preceding onset of illness. Alternatively, they may not necessarily be severely ill, but have had definite exposure to VHF (see 9.2.3). This would include hospital and laboratory staff who have developed illness within three weeks of last known contact with a VHF patient or fomites associated with such a patient. The same applies to relatives and close associates of a known VHF patient.

3.5 Measures should be applied to minimise exposure of medical staff, other patients and relatives as soon as a diagnosis of VHF is seriously entertained. Whatever is ultimately decided concerning the management of the case, the immediate course of action should be:-

3.5.1 Isolate the patient and apply the basic principles of barrier-nursing as best as can be managed under the circumstances (see 5.1).
3.5.2 Administer such life-preserving therapy as may be necessary and possible, e.g. blood/fluid therapy.

3.5.3 Take steps to verify the diagnosis (see 4.1, 4.2 and 4.3).

3.5.4 Decide whether the patient is to be retained at the primary hospital (e.g. low risk case), or whether to seek transfer of the patient to a secondary hospital which is more suited to dealing with the case or has been specifically designated for receiving and treating VHF patients (see 6.4).

Decisions to transfer VHF patients cannot be taken unilaterally. The criteria for referral of patients and the mechanism for reaching a decision are discussed in sections 6.1, 6.2 and 6.5.

3.5.5 Notify the Regional Director of National Health and Population Development of the existence of a suspected case of VHF if he/she has not already been made aware of the case in the course of negotiations concerning possible transfer of the patient, as well as the office of the Director-General of National Health and Population Development (see 9.1.1 and 9.1.2).

- x -
4 VERIFICATION OF THE DIAGNOSIS

4.1 Systematic consideration of differential diagnoses

4.1.1 Systematic investigation of suspected VHF should begin with careful consideration of possible differential diagnoses, taking into account the particular circumstances of the case under investigation.

4.1.2 Where there has been travel or residence in rural or remote parts of Africa, diagnoses could include malaria, trypano-somiasis and relapsing fever.

4.1.3 The most frequent causes of suspected VHF in South Africa have been found to be bacterial septicaemias including streptococcal, staphylococcal, meningococcal, typhoid and miscellaneous gram-negative septicaemias. Primary sites of bacterial infection have included wounds, fractures, dental abscesses, sore throat, pneumonia and perforated gastrointestinal ulcers.

4.1.4 Fulminant hepatitis A (particularly in white people), hepatitis B, severe tick-borne typhus (tick-bite fever), systemic herpesvirus infections, snake-bite and drug sensitivities and overdoses have also been involved.

Plague, leptospirosis, generalized varicella-zoster, cytomegal and E-B virus infections, haemorrhagic measles, neoplasia and tribal medications should be borne in mind.

Acute pancytopaenia as a result of intoxication with organic chemicals, e.g. "glue sniffing", agricultural and industrial chemicals, is another possibility.

Haemostatic failure can occur in patients on anticoagulant therapy.

- x -
4.2 Laboratory tests to exclude non-VHF diseases

4.2.1 Immediately VHF is suspected, the clinician should determine what laboratory tests have already been performed or are in progress. All specimens should be traced and laboratory personnel warned of the suspected diagnosis to allow them to take the necessary precautions. All further specimens sent to the laboratory should be double-wrapped in clear plastic and appropriately labelled, preferably with biohazard stickers, to alert staff to the highly infectious contents. Such specimens should not be sent through normal channels, e.g. vacuum tube, but should be delivered by hand (see 7.3.3).

4.2.2 Many tests which are normally conducted in haematological, microbiological or clinical chemistry laboratories, are of great help in differentiating non-VHF from VHF. Specimens from suspected VHF patients should only be handled with due precautions and protective clothing in a suitably isolated environment (see 4.2.4 and 7.3.2). The tests include:-

4.2.2.1 Examination of a stained blood smear

This simple and rapid test can be very useful. Malaria, trypanosomiasis and other haemoparasitic diseases can be diagnosed and a differential white cell count can be performed on the smear. Frequently, it can provide an indication of anaemia, leukocytosis, leukopaenia and even thrombocytopenia.

4.2.2.2 Full haematological examination

This is preferable to mere examination of a blood smear.

Granulocytosis suggests bacterial infection.

Findings which suggest VHF include leukopaenia, thrombocytopenia, anaemia, reduced clotting parameters and increased fibrin degradation products, but disseminated intravascular coagulopathy occurs in many conditions, including bacterial infection.

Leukocytosis occurs in the later stages of some VHFs (see section 11) and in leukaemia.

4.2.2.3 Bacteriological blood cultures

It is very important that blood cultures should be done to exclude septicaemia.

Samples should be taken before antibiotic therapy is instituted.

4.2.2.4 Clinical chemistry tests

Raised serum bilirubin and liver enzyme levels occur commonly in VHF, but jaundice and hepatocellular damage have many causes. Evidence of severe liver damage is a poor prognostic
Proteinuria is common in some VHF.

4.2.2.5 Specific serodiagnostic tests for non-VHF diseases

Anti-HA IgM, HBsAg and Anti-HBc are important screening tests for hepatitis A and B.

Serodiagnostic tests are available for tick-borne typhus, leptospirosis, salmonellosis, measles, herpesvirus infections and many other diseases which could be confused with VHF.

4.2.3 If any of the above tests have not been completed in a local laboratory at the time that VHF is first suspected, or cannot be completed in safety in a local or regional laboratory with suitable facilities (see 4.2.4 below), then specimens such as bacteriological blood cultures could be forwarded to the National Institute for Virology along with specimens submitted specifically for virological tests (see 4.3).

4.2.4 There is a need for laboratories which are able to perform at least a minimum range of the above tests on specimens from suspected cases of VHF. Such laboratories should be available at least on a regional basis and, indeed, a few laboratories have been designated for this purpose (see 6.4). The essential features of a suitable laboratory are described in section 7.3.2.

4.2.5 To some extent, specimens can be treated to reduce the risks involved in performing tests:

Sera used for hepatitis, other serodiagnostic tests, glucose, BUN and electrolyte determinations, can be heated to 60°C for 30 minutes. This inactivates class IV viruses, but it should not be presumed that samples are rendered completely safe.

Heating to 60°C for 1 hour has been recommended as producing safe specimens, but in our experience this is likely to denature serum.

The 3% acetic acid commonly incorporated in diluents for total leukocyte counts, renders blood safe.

No treatment to render blood safe, including irradiation, yields satisfactory samples for enzyme and coagulation factor studies.

4.3 Submission of specimens for virological examination

Specific diagnostic tests for the formidable (class 4) VHF are performed only by the Special Pathogens Unit of the National Institute for Virology.
4.3.1 Source and nature of specimens

Specimens submitted to the National Institute for Virology may come from:-

4.3.1.1 Clinical laboratories

Early specimens must be traced and recalled from haematology, bacteriology, clinical chemistry and other laboratories and submitted for virological examination. These are important because virus is frequently only present in blood and tissues in the initial stages of disease.

4.3.1.2 Live patients

Specimens specifically taken for virological and/or serological examination from live patients should include 5 to 10ml of clotted blood, 5ml of blood taken with EDTA/sequestrene (lavender top), throat swabs and up to 25ml of urine. See 7.3.3 for removal of specimens from patient facility.

4.3.1.3 Corpses

There is frequently understandable and prudent reluctance to proceed with full autopsy until VHF can be excluded, but minimal specimens to achieve this aim should include heart blood taken by needle and needle "biopsies" of liver. A fairly large-bore needle should be used and some liver placed in fixative for histopathological examination and some placed in a small volume of physiological saline for virological examination. If possible, material should also be placed in 2.5% glutaraldehyde fixative for electromicroscopy. Blood will tend to ooze from needle puncture sites and these should be taped or sealed (e.g. "Opsite", S & N Pharmaceuticals (Pty) Ltd., P O Box 92, Pinetown, 3600). The body should be decontaminated and sealed in layers of stout plastic shrouds as discussed in section 5.11. See 7.3.3 for removal of specimens from patient facility or mortuary.

4.3.2 Packaging of specimens

The packaging of specimens should be as follows:-

4.3.2.1 Primary specimen containers such as blood tubes (properly labelled) should be wrapped in sufficient absorbent material (paper towels or tissues) to absorb the entire contents in the event of leakage.

4.3.2.2 The wrapped primary containers must be placed in durable, leak-proof secondary containers such as several layers of sealed plastic bags or, preferably, rigid screw-cap metal, plastic or similar containers (suitable containers are usually available from hospital dispensaries). The secondary container should be taped closed to prevent leakage.
4.3.2.3 The secondary containers and data forms, sealed separately in plastic, must then be placed in an outer polystyrene container (cold box) with cold packs. Specimens, particularly whole blood, should not be frozen.

The outer wrapping should be addressed to:-

Special Pathogens Unit  
National Institute for Virology  
Private Bag X4  
Sandringham, 2131  

(Telephone: 011 321 4200)

The parcel should bear appropriate warning that it contains biohazardous material, preferably in the form of stickers AW 285 or AW 285 A with the international biohazard symbol (see illustration), which are available at airport cargo facilities.

Parcels sent by air should also be marked:-

"UN 2814 Hazard Class 6,2."

In addition to completing an ordinary "Air Waybill" it is also necessary to complete a "Shipper's declaration for dangerous goods" (document AW 349) as per attached example.

4.3.3 Information to accompany specimens

Specimens must be accompanied by at least the following information:-

4.3.3.1 Brief clinical details, **date of onset of illness, date on which specimens were taken**, treatment (antibiotics, immune plasma, antivirals and other drugs, age, sex and occupation of the patient, place of residence (town/farm), history of recent travel away from home and suspected diagnosis.

4.3.3.2 The **legible** name of a clinician who bears knowledge of the case and telephone numbers where this person may be contacted during and after work hours. This facilitates communication and allows quick reporting of findings. Sometimes it is difficult to establish even which hospital or province specimens have come from!
INSERT NEW REQUEST FORM
VERSOEKVORM: VERDAGTE VIRUS HEMORAGIESE KOORS (VHF)  
(VOLTOOIDE VORMS MOET MONSTERS VERGESEL)

Dokter....................................  Pasient .................................................................
Adres .................................................................
Oouerdom .............................................  Geslag .................................
Hospitaal Nr. ........................................  Saal .................................
Hospitaal .................................................................
Telefoon (werk) ......................................  Na-uurs .................................
Datum opgeneem .................................
Monster/s .................................................................
Verdagte siekte/toete verlang ......................................  Geskiedenis van moontlike kontak met VHK/blootstelling .................................................................


Kliniese geskiedenis en ondersoek.................................................................


L.W. AANVANGSDATUM VAN SIEKTE

Behandeling (antibiotika/antimalaria)


Laboratoriumtoetse reeds voltooi:

Datum.................................
Leukosiete.................................
Differensieel
Plaatjies.................................
Hemoglobien.................................
Malaria parasiete ................................
Bloedkultuur.................................


English overleaf
4.3.3.3 It is recommended that special VHF specimen submission forms, or photocopies thereof, should be used (see example on page D9). Alternatively, all the required information should be included on the specimen submission form normally used.

4.3.4 Transmission of specimens

4.3.4.1 Urgent specimens should be consigned directly to the National Institute for Virology. In various circumstances it may be quickest to utilise either air, road or rail transport, or a combination thereof.

IT IS ESSENTIAL THAT THE SPECIAL PATHOGENS UNIT SHOULD BE INFORMED IN ADVANCE WHEN URGENT SPECIMENS ARE DESPATCHED (TELEPHONE SEE SEPARATE LIST FOR NUMBERS)

Less urgent specimens can be sent via the laboratory route normally utilised for virological specimens. This would apply, for instance, to sera from healthy contacts of a VHF patient which are being sent for routine screening (see laboratories in directory section).

4.3.4.2 Special arrangements have been made with South African Airways for shipment of specimens. In most instances it is only necessary to hand in properly packaged and labelled specimens and documents (see 4.3.2.3) at cargo handling facilities in the normal way. However, where urgent specimens have to be sent at short notice, they can be handed to the duty Shift Clerk at the cargo handling facility of the airport concerned up to 30 minutes before departure of flights. At small airports, the Airways Station Manager will receive such late packages. It is preferable that these officials should be informed per telephone of the impending arrival at the airport of late specimens (see directory section for telephone numbers). These officials may also be in a position to hold specimens under refrigeration where there is need to await the next available flight.

4.3.4.3 Road transport

Urgent specimens from hospitals close, or relatively close, to the National Institute for Virology, can be sent directly by road transport. The Institute is situated on the Modderfontein Road, close to the turn-off of this road from the N3 highway, at the boundary of Johannesburg and Edenvale municipalities. A map is included in the directory section.

There is twice daily delivery of specimens by van from the South African Institute for Medical Research in Johannesburg to the National Institute for Virology.
4.3.4.4 The Special Pathogens Unit of the National Institute for Virology should be informed per telephone, fax or e-mail of the impending arrival of specimens. The means of transport, train or flight number and, if known, air waybill number, should be given.

In case of doubt consult the Special Pathogens Unit about the taking of specimens and the best means of forwarding these (see directory section).

4.3.5 Examination of specimens and reporting of results

4.3.5.1 If the Special Pathogens Unit has been informed of the impending arrival of urgent specimens, parcels will be collected and emergency tests performed at any hour.

4.3.5.2 Cases of VHF are diagnosed in the acute phase of infection by isolating virus or in the convalescent phase by demonstrating an antibody response.

Antibody tests can be completed within two hours of receipt of specimens and isolation and identification of virus can sometimes be achieved in two days, but may take a week or much longer.

All serum samples (acute and convalescent) are routinely tested for antibodies to the full range of African VHF viruses immediately on receipt of the specimens and the results are made known as soon as possible. However, it is important to remember that all specimens are also cultured for virus content and this can be a lengthy process: SPECIMENS WHICH ARE REPORTED TO BE NEGATIVE FOR ANTIBodies COULD WELL YIELD VIRUS IN CULTURE SOME DAYS LATER. This has led to misunderstandings in the past.

4.3.5.3 Failure to isolate virus from serum during the first 7 days of illness or to demonstrate antibodies two weeks after onset, is a fair indication that one of the known African VHFs is not involved. However, viraemia may be of very short duration or absent. Hence, negative findings on samples taken early in the course of disease should be supported by antibody tests on further specimens taken in convalescence.

4.3.5.4 It is worth stressing that a sample from an acutely ill patient will most likely lack antibodies and isolation of virus will probably take days: sending of urgent specimens on evening flights therefore frequently results in a negative antibody test being reported per telephone after midnight, and there is little advantage to be gained over sending the specimens on a morning flight the following day. However, rapid diagnostic techniques are in constant review and the merits of a particular course of action can be decided separately for each case.
5. ISOLATION AND HIGH SECURITY BARRIER-NURSING OF VHF PATIENTS

5.1 Introduction

Cases of VHF are often first suspected or diagnosed in ordinary hospitals or other medical institutions which lack special facilities for isolation of patients. Nevertheless, every effort should be made to isolate the patient and to apply the principles of high security barrier-nursing as soon as a diagnosis of VHF is seriously entertained. The precautionary measures must remain in force until the possibility of VHF has been excluded or the patient has been transferred to a designated secondary hospital for treatment of VHF.

The following notes serve merely as guidelines: each medical institution should formulate its own contingency plans and all members of staff should receive detailed and specific instructions so that they are able to act in an informed manner whenever a suspected case of VHF is encountered.

5.2 Administrative requirements

In exactly the same way as regional VHF centres (see 8.2, 8.3), every hospital should establish its own VHF Committee of senior clinicians, nursing staff and administrators to formulate contingency plans and to implement them whenever a suspected or confirmed case of VHF is encountered. Such a Committee achieves its purposes by delegation of duties. For example, the initial assessment of suspected cases of VHF should be performed by a pre-arranged panel of clinicians (see 3.3, 6.5.1); staff should be trained in recognition of VHF and in barrier-nursing techniques by a team of senior clinicians and nurses while the securing of facilities, supplies and logistics should be handled by appropriate administrative staff (see 8.4.2).

It is of the utmost importance that proper channels of communication are established so that the relevant members of staff at all levels are informed promptly of the existence of a suspected case of VHF, or of the impending arrival at the hospital of such a case, and of all key developments in the handling of the case. The system of communication should extend beyond the hospital to include all outside officials who need to be kept informed (see 9.1.1).

5.3 Facilities

5.3.1 The minimum accommodation required for barrier-nursing of a patient consists of one room in which the patient may be isolated and an ante-room or adjacent room where staff can don and remove protective clothing. It is an advantage if the ante-room has a hand-basin and if ablution facilities are located in convenient proximity to the patient's room.
5.3.2 In addition there should be;

5.3.2.1 an area suitable for a nursing and medical station;

5.3.2.2 an area or room for storing supplies and equipment;

5.3.2.3 a room or enclosed area for changing from street clothes into surgical theatre or equivalent clothing (over which a final layer of protective clothing is donned in the ante-room to the patient's room (see 5.7).

5.3.3 The need may arise for room/s in which to place high risk contacts of VHF (see 9.2.3.7, 9.3.5).

5.3.4 It is convenient if a two-way communications system can be installed between the patient isolation room and the nursing station.

5.3.5 It is recommended in published literature on barrier-nursing techniques that if there is an air-conditioning system in the isolation suite, then the pressure in the suite should be negative with respect to the rest of the building and that the air should be discharged and not recirculated. Otherwise, recirculated air should pass through a high-efficiency (Hepa) filter. These principles should be adhered to in planning and constructing a new isolation suite, but there is no evidence that air-conditioning systems in existing patient-care facilities have constituted a hazard in the barrier-nursing of the VHF's encountered in this country.

5.4 Equipment and supplies

5.4.1 Equipment required in the patient isolation room

The patient isolation room must have the following items which should not be removed unless they are decontaminated (see 5.10):

- Sphygmanometer
- Stethoscope
- Thermometers
- Urinal and bedpan
- Bucket, disinfectant (see 5.9.5) and disposable cleaning cloths
- Clock with second hand
- Drip stand
- Urine testing and measuring equipment

Other items (bed, locker, ventilator, monitor, etc.) are placed in the isolation room for patients being received from outside the hospital, or are transferred from the original ward together with patients being moved into isolation within the same hospital.
5.4.2 **Supplies to be kept outside of the patient isolation room**

Supplies to be kept outside of the patient isolation room include protective wear, much of it available in disposable plastic or paper form at all hospitals and clinics:

- Theatre tops and trousers or equivalent cover-all garments (available also in disposable form)
- Gowns (long-sleeved, waterproof, disposable type)
- Vinyl or rubber aprons
- Balaclava-type caps (disposable)
- Face masks, theatre type
- Goggles, plastic
- Latex gloves
- Canvas or similar slip-on shoes
- Overshoes (disposable) or stout plastic bags

In planning for the above supplies, it should be borne in mind that up to 25 changes of protective clothing may be required per day in nursing a patient during the critical phase of VHF illness, although not all patients become severely ill or exhibit bleeding tendencies.

Some hospitals utilise mended and condemned linen and theatre clothes for nursing VHF patients, but dye these items an obvious colour to help ensure that they are incinerated or otherwise disposed of safely and not laundered in routine manner.

In addition to the above there is need for a supply of:-

- Masking or autoclave tape
- Ballpens
- Felt-tip marker pens
- Specimen containers and labels
- Patient record forms
- Disposable syringes and needles
- Swabs
- Adhesive bandage (e.g. "Elastoplast")
- Scissors
- Refuse bags and bins
- Plastic or paper autoclave bags
- Small, clear plastic bags (for removal of specimens or small items from the patient’s room)
- Biohazard labels
- Disposable eating utensils
- Disinfectants (see 5.9.5) and disposable cleaning cloths
- Paper towels
- Desk, chairs
- Restricted entry and hazard warning signs
- Register to record entry and exit particulars
Ideally, hospitals should set aside stocks of the essential items as a matter of preparedness for possible requirement in epidemic disease emergencies. In any event, stocks should be secured immediately an emergency arises and it is useful to appoint a senior member of the nursing or administrative staff to be responsible for acquiring and controlling supplies of consumables during the emergency. Formidable epidemic disease packs (FED packs) containing virtually all of the above items, including the protective clothing, are available at regional hospitals in the Cape province. Similar packs can be prepared and kept available at strategic regional hospitals in the other provinces.

5.4.3 Safety equipment

Many of the designated secondary hospitals for treatment of VHF patients (see 6.4) have acquired special safety equipment for protection of staff against nosocomial infections. The items vary from clear acrylic visors through full-face respirators (gas masks) and positive-pressure ventilated respirators to containment bed isolators (see 10). Unless there are strong contra-indications (see 6.2), VHF patients must be transferred to such properly equipped secondary hospitals.

In exceptional instances where it is decided that the patient must remain in, and be nursed in the primary hospital (see 6.2), it is possible to borrow equipment such as positive-pressure ventilated respirators (see 10.1.3) from secondary hospitals. It should be remembered that a power supply point will be required in the ante-room for re-charging the batteries of the respirators and a rack or coat hooks are required for hanging respirators when not in use.

It is worth stressing that the need for sophisticated safety equipment varies with the severity of the haemorrhagic state of the patient and over the past 7 years in South Africa many VHF patients (most of them suffering from Crimean-Congo haemorrhagic fever), have been nursed without special equipment other than the protective clothing itemised in section 5.4.2 above.

5.5 Personnel

5.5.1 Ideally, specifically trained, volunteer staff should be used for nursing of VHF patients and whenever possible, personnel who were in contact with the VHF patient/s before barrier-nursing was implemented, should be utilised first.
5.5.2 Nosocomial infections can almost invariably be traced to fundamental lapses in technique, such as needle-pricks, against which the most elaborate of safety equipment cannot protect. Fatigue causes mistakes and adequate numbers of staff should be delegated to barrier-nursing without seriously depleting the rest of the hospital or unnecessarily exposing too many individuals to VHF. If the nursing load is too heavy, as when more than one patient is involved, it may be necessary to suspend some or all routine functions of the hospital.

5.5.3 Work shifts should be limited to a maximum of 8 hours and shifts of 6 hours are preferable to ensure a high degree of efficiency.

High profile nursing of critically ill VHF patients may require up to 5 persons per shift, 2 of whom are in the patient isolation room on a 1-2 hourly rotation.

Low profile nursing of moderately ill patients requires less staff and in many instances it is not necessary to maintain a constant presence in the patient isolation room.

5.5.4 In addition to the staff who actually nurse the patient, it is essential to have at least one member of the nursing or administrative staff who remains outside of the isolation area to control communications, logistics and access to the isolation suite. In large hospitals it may be necessary to use security officers to control access to the isolation suite.

5.5.5 Domestic and any other staff who have not been specifically instructed in barrier-nursing procedures should be excluded from the isolation suite.

5.5.6 All medical and auxiliary staff (e.g. ambulance personnel) who come into contact with a suspected or confirmed VHF patient, either before or after the institution of barrier-nursing precautions, must be placed under observation (see 9.3). This should be done formally but the precautionary nature of the measure should be explained carefully: even medical personnel can be highly suggestible. Baseline blood counts and liver enzyme levels should be recorded and serum samples kept in frozen storage for possible later use in instances where suspected nosocomial infection occurs.

5.5.7 All incidents constituting possible exposure to infection, e.g. needle-pricks or other direct contact with patient's blood, must be recorded and promptly brought to the attention of the hospital's VHF Committee who may decide to admit high risk contacts to an observation ward (see 9.2.3.7 and 9.3.5).

5.6 Placing a patient into isolation

5.6.1 Explain to the patient and family that barrier-nursing is being instituted and make an effort to reassure them. The donning of protective clothing by medical personnel can have a demoralising effect on laymen.
5.6.2 Establish from the clinician in charge whether or not the patient's immediate family will be permitted to visit the patient (under supervision and with proper protective clothing). Inform the family accordingly and arrange for instruction in correct use of protective clothing.

5.6.3 Ensure that all staff are informed that the patient is being placed into isolation, institute control over access to the isolation suite and display warning notices. Henceforth only specifically authorised personnel may have access to the patient and all medical and nursing staff must wear protective clothing when tending the patient (see 5.7).

5.6.4 The patient is transferred to the isolation room on his bed and all other items of equipment required from the original ward (e.g. locker, ventilator, monitor, etc.) are moved with the patient (see 5.4.1). (The procedure for receiving VHF patients from outside the hospital is described in section 6.6.4.5).

All non-essential items, including the patient's records, are left in the original ward and are decontaminated in the prescribed manner (see 5.10) by personnel wearing protective clothing. New patient records are started and kept outside of the isolation room.

5.6.5 All other patients who were in the original ward with the VHF patient are transferred, preferably to a single other ward, so that the original ward can be decontaminated (see 5.10).

Sometimes it is most convenient to leave the VHF patient in the original ward and to convert this into an isolation room.

5.6.6 Ensure that a specifically appointed member of the VHF team prepares a register of all persons deemed to have had contact with the VHF patient/s and places contacts under observation (see 5.5.6 and 9.3).

Ensure that a register is kept of all visits to the patient.

5.7 **Dressing for entering the patient isolation room**

5.7.1 In a change-room or other suitable area close to the entrance to the isolation suite, barrier-nursing staff replace their top clothes with surgical theatre tops and trousers, or equivalent cover-all garments, plus canvas or similar slip-on shoes.

5.7.2 Persons proceeding beyond this area to the patient isolation room, don a layer of protective clothing in the ante-room to the isolation room:-
Long-sleeved, waterproof, disposable gown
Vinyl or rubber apron (if more than light duties involved, e.g. bleeding patients)
2 pairs of latex surgical gloves, one over the other Balaclava-type disposable cap
Disposable face-mask
Goggles
2 pairs of overshoes, one over the other, or heavy duty plastic bags
A full-face respirator (gas-mask) if used, would replace the face-mask and goggles while a positive-pressure ventilated respirator with hood would replace the balaclava, face-mask and goggles.

5.7.3 Aerosol infections can theoretically occur when patients bleed from the nasopharynx, cough, vomit or sneeze. In instances where aerosol infection is considered to be a serious threat, personnel should wear full-face (gas-masks), or positive-pressure respirators.

5.7.4 Needles, other sharp objects, patient's blood, blood- contaminated discharges and equipment soiled with blood constitute the greatest danger and must be handled with extreme care. Gloved hands contaminated with patient's blood or discharges should be dipped into a disinfectant solution (see 5.9.5) kept in the isolation room. Gloves must be checked frequently for tears or punctures and if the patient bleeds profusely, both inner and outer gloves must be changed hourly and the hands washed in disinfectant.

5.8 Procedure for leaving the patient isolation room

The procedure for leaving the isolation room must be followed strictly to prevent contamination of people and the environment.

5.8.1 Refuse or autoclave bags, which are used to receive discarded protective apparel, are placed in a bin or holder in the ante-room with 20 to 30 cm of the top of the bag folded back over the bin or holder to form a clean margin when the bag is sealed. The bin is placed close to the door leading from the patient isolation room.

5.8.2 On leaving the patient isolation room, the outer overshoes are removed and placed in the disposal bag. Waterproof overshoes may be dipped into a bucket of disinfectant (see 5.9.5) before being removed.

5.8.3 The outer gloves are dipped or washed in disinfectant (see 5.9.5), peeled off and discarded into the disposal bag.
The inner gloves are used to remove the other items of protective wear and place them in the disposal bag.
5.8.4 Goggles or gas-mask are removed and placed in disinfectant or into a plastic bag for gas sterilization (see 5.9.4). If a positive-pressure respirator is being worn, an assistant in the ante-room swabs or sprays the outer surface of the hood with disinfectant (see 5.9.5) and with gloved hands helps to remove the respirator.

5.8.5 Face-masks and balaclava caps are removed and placed in the disposal bag.

5.8.6 Next, aprons and gowns are removed and folded or rolled so that outside surfaces are on the inside and they are placed in the disposal bag.

5.8.7 The inner pair of overshoes and finally the inner gloves are removed and placed in the disposal bag.

5.8.8 The disposal bag is sealed, conveniently with plastic cable-ties obtainable from electrical or hardware stores, or with adhesive tape. The bag is sealed into a second bag, or several layers of bags if they are flimsy.

It is useful if the outer bag is colour-coded, e.g. red, to indicate that it contains biohazardous material due for incineration (see 5.10.1 and 5.10.2).

5.8.9 If convenient, staff should take a shower bath before leaving the isolation area.

5.9 Disinfectants

FOR QUICK REFERENCE SEE 5.9.5

Use of disinfectants is no substitute for sterilization by physical means, especially heat as in autoclaving or incineration. However, there may be situations and applications in the nursing of VHF patients where it is necessary to resort to disinfectants. It should be remembered that mechanical cleansing is an integral part of proper disinfection. Excess organic matter rapidly reduces the efficacy of most disinfectants.

The following discussion of disinfectants is not exhaustive and the use of brand-names does not imply particular recommendation of a product.

5.9.1 Halogens

5.9.1.1 "Organic" chlorine formulations

Chlorine is an effective disinfectant, but inorganic chlorine is corrosive to metals and can degrade fabrics. Hence, there are formulations which incorporate a detergent, an anti-corrosive agent and chlorine incorporated in or complexed to organic molecules (chloro-cyanurates and chloramines).
5.9.1.1 A preparation of this nature is sold in South Africa as "Chlorocide D" (syn. "Biocide D") (Exactachem Pty Ltd, P O Box 995, Wendywood 2144). This product is supplied as a dry powder in 6g sachets which yield 250ppm of chlorine when dissolved in 9L of water. Stronger solutions are prepared by adding multiple sachets or reducing the water volume, e.g. 500ppm chlorine is prepared by adding two sachets of powder to 9L of water or one sachet to 4.5L. Solutions should be prepared immediately prior to use and discarded if not put to use within 3 hours.

Chlorocide D solutions yielding 500 to 1000ppm of chlorine are used on surfaces where there is no gross contamination with organic matter, e.g. bedding, lockers, walls, floors, respirators and instruments.

Concentrations of Chlorocide D yielding 2000 to 4000ppm of chlorine are used where there is contamination with organic material, e.g. excreta, blood, vomitus, or for disinfection of corpses. A contact time of at least 30 minutes should be allowed for excreta, vomitus and spillages.

5.9.1.1.2 Trichloro-cyanurate granules as sold for the treatment of swimming pools can be used as a disinfectant in an emergency. Three teaspoonfuls of the granules should be added to 5L of water. Note: this compound should not be confused with inorganic high test hypochlorite (HTH) discussed under 5.9.1.2.2 below.

5.9.1.2 Inorganic chlorine

5.9.1.2.1 Where no "organic" chlorine is available, it is satisfactory to use 0.5% hypochlorite solution (1:10 aqueous solution of brandname household bleaches or 1:30 dilution of 15% commercial solution of sodium hypochlorite). However, the corrosive effects of inorganic chlorine should be borne in mind.

One or two crystals of potassium permanganate can be added to undiluted hypochlorite stocks. This has a synergistic effect and imparts a purple colour which makes it easier to recognize diluted solutions. Addition of too much permanganate can cause the solution to impart brown stains.

5.9.1.2.2 Calcium hypochlorite sold as high test hypochlorite (HTH) for the treatment of swimming pools, is an effective inorganic chlorine preparation which can be used as a disinfectant at the rate of 1 teaspoonful per 5L of water.
5.9.1.2.3 An apparatus is available which uses calciumhypochlorite tablets to provide

5.9.1.3 **Iodine preparations**

Preparations containing organic iodine complexes (iodophors or povidone-iodine) are used for rinsing gloves or washing hands, e.g. "Wescodyne" and "Betadine H" (Adcock Ingram Home Products Ltd, P O Box 660, Isando 1600. Tel: 011 921 1511).

Tincture of iodine is an excellent skin disinfectant for taking blood culture samples, but is allergenic in a small proportion of people. It can be removed from skin with alcohol. (Ethyl and isopropyl alcohols are used as skin disinfectants for injections.)

5.9.2 **Aldehydes**

5.9.2.1 **Formaldehyde** can be used for fumigation of rooms (see 5.10.10).

5.9.2.2 **Activated glutaraldehyde** disinfectants can be used on walls and floors and as a general disinfectant for excreta, vomitus and spillages, e.g. "Cidex" (Johnson and Johnson Pty Ltd, Voortrekker Road, East London 5201). Cidex is supplied at working strength and retains its potency for 14 days after the activator powder is added to the liquid.

5.9.2.3 **An aldehyde and quaternary ammonium compound mixture**, sold as "Tegodor 73" (T and C Chemicals, P O Box 143, Isando 1600) can be used for spraying or immersing plastic, rubber and other impervious items, such as the insides of isolators or external surfaces of respirators. A 3% solution is used and it is convenient to keep the diluted disinfectant in a hand-operated spray bottle for use in isolators or on respirators. The disinfectant should be washed or rinsed off with water before these items are used again.
The same formulation, with a perfume added, is sold as "Tegodor" for use as a general disinfectant. A 2% solution is used on walls, floors and spillages.

5.9.2.4 Care should be exercised in the use of the above group of disinfectants (formaldehyde/formalin, glutaraldehyde and aldehyde) since the fumes can be overwhelming and toxic in confined, poorly-ventilated spaces.

5.9.3 **Phenols and related compounds**

5.9.3.1 It may be necessary to resort to common household phenolic disinfectants, e.g. Lysol, for general use on walls, floors and spillages. They are used at concentrations of 3 to 5% and, as with aldehydes, the fumes can be overwhelming in confined, poorly-ventilated spaces.

5.9.3.2 Chlorheximide, a bisdiguanide antiseptic, is incorporated in "Hibiscrub", "Hibitane" solutions and "Savlon" preparations [ICI South Africa (Pharmaceuticals) Ltd, Leyds Street, Braamfontein 2001] which are used for rinsing gloves or washing hands.

5.9.4 **Ethylene oxide** gaseous sterilization of plastic, rubber and other items which cannot withstand heat sterilization, requires special equipment and is available in large centres, sometimes as a commercial service. It is used for protective respirators at the termination of treatment of a patient (see 5.10.5).

5.9.5 Summary of disinfectants and their applications - see next page.
### 5.9.5 Summary of disinfectants and their applications

The list of disinfectants is given to allow use of alternatives where particular preparations are not available.

**FOR MOST PURPOSES IT IS SATISFACTORY TO USE CHLOROCIDE D AT 500 -1000 ppm FOR SURFACES AND 2000 - 4000 ppm FOR ORGANIC WASTES.**

<table>
<thead>
<tr>
<th>Application</th>
<th>Disinfectant</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>General disinfection: walls, floors, drains,</td>
<td>Chlorocide D</td>
<td>500-1000ppm (surfaces)</td>
</tr>
<tr>
<td>excreta, spillages, disposal bags, footwear etc</td>
<td>Chlorocide D</td>
<td>2000-4000ppm (organic material)</td>
</tr>
<tr>
<td></td>
<td>Sodium hypochlorite</td>
<td>0.5% (standard strength)</td>
</tr>
<tr>
<td></td>
<td>Tegodor Phenolic disinfectants</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-5%</td>
</tr>
<tr>
<td>Plastic and rubber: isolators, respirators</td>
<td>Tegodor 73</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Chlorocide D</td>
<td>500-1000ppm</td>
</tr>
<tr>
<td></td>
<td>Sodium hypochlorite</td>
<td>0.5% gaseous sterilization</td>
</tr>
<tr>
<td></td>
<td>Ethylene oxide</td>
<td></td>
</tr>
<tr>
<td>Gloves and hands</td>
<td>Wescodyne</td>
<td></td>
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<tr>
<td></td>
<td>Betadine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hibiscrub</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hibitane solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Savlon</td>
<td></td>
</tr>
<tr>
<td>Decontamination of rooms at termination of</td>
<td>Formaldehyde fumigation</td>
<td>(see 5.10.10)</td>
</tr>
<tr>
<td>treatment</td>
<td>Cidex</td>
<td>(standard strength)</td>
</tr>
<tr>
<td></td>
<td>Tegodor</td>
<td>2%</td>
</tr>
<tr>
<td>Skin (blood cultures)</td>
<td>Tincture of iodine</td>
<td></td>
</tr>
<tr>
<td>Skin (injections)</td>
<td>Ethyl or isopropyl alcohol</td>
<td></td>
</tr>
</tbody>
</table>
5.10 Decontamination and disposal of hazardous items
At least one senior individual in each nursing shift should be responsible for supervising decontamination and disposal of biohazardous items.

5.10.1 All items leaving the isolation unit (patient's room and anteroom) should be enclosed in sealed autoclave or refuse bags and the outer surfaces of the bags should be wiped with a general disinfectant (see 5.9.5). It may be necessary to use several layers of bags for safety and the outer bag may be colourcoded, e.g. red, to indicate that the parcel contains biohazardous material.

5.10.2 Disposable items should be sent for incineration under supervision and re-usable items for autoclaving.

5.10.3 Crockery and cutlery used for feeding patients should ideally be of disposable type and incinerated along with food wastes.

5.10.4 Bedpans and other containers with secretions, excretions and other wastes such as vomitus and blood, should be treated with a general disinfectant (see 5.9.5) for at least 30 minutes and then placed in a leak-proof autoclave bag or other secure secondary container (e.g. stainless steel container) before removal for autoclaving and cleaning. Autoclaved wastes can be flushed into municipal sewers. After flushing, the bedpans are cleaned with disinfectant.

Otherwise, thoroughly disinfected wastes (prolonged exposure to copious disinfectant) should be discarded into sealed disposal pits, or buried.

It is very convenient to use a chemical toilet instead of bed pans, especially for an ambulant patient. These are available from the Emergency Services Centre, Cape Town (see page T35).

5.10.5 Vinyl, certain rubber and other items which would be degraded by autoclaving should be discarded and incinerated or immersed in disinfectants (see 5.9.5).

Protective respirators are sprayed with disinfectant during use (see 5.8.4) and at the termination of patient treatment are disinfected, packed into their boxes and dispatched for ethylene oxide sterilization.

5.10.6 Sharp instruments, particularly hypodermic and intravenous needles, should be
used with great care. Used needles should be discarded into rigid-walled plastic or metal containers with a general disinfectant (see 5.9.5) and sent for autoclaving or incineration. Dispensaries are a good source of suitable containers.
5.10.7 **Used linen and cloth items** of protective wear should be autoclaved, but consideration should be given to merely incinerating grossly contaminated items such as bloodstained mattresses and pillows.

5.10.8 **Vomitus, blood and other spillages** on floors and similar impervious surfaces should be flooded with a general disinfectant (see 5.9.5), covered with cloths or paper towels and, if convenient, left for 30 minutes before removal.

5.10.9 **Floors** should be mopped and drains flushed with disinfectant (see 5.9.5) once or twice a day.

5.10.10 **Rooms** should be fumigated at the termination of patient treatment **only if this can be done safely**.

A satisfactory alternative to fumigation is to swab ceilings, walls, floor and fittings with inorganic chlorine or an aldehyde disinfectant (see 5.9.5).

For fumigation, all openings should be closed and sealed with tape. Fumigation is more efficient in a moist atmosphere and walls and floors should be dampened. For every 30 cubic metres of enclosed space, 300ml of formalin (40% formaldehyde) and 100g of potassium permanganate are placed in an open bowl. The permanganate is added to the formalin just before the operator departs through and seals the entrance. The room is kept sealed overnight and ventilated thoroughly before it is entered again. Splashing dilute ammonia solution in the room helps to neutralize formaldehyde fumes. Windows should be opened and fans used to help ventilate the room.

The same procedures can be applied to mortuaries and laboratories.

5.10.11 **Patient records** can be autoclaved or sent in plastic wraps for gaseous sterilization (see 5.9.4), if they have been kept in an infected environment. The information must be preserved and can be copied from records taped to a window, or transmitted via an intercom or telephone.

5.11 **Disposal of corpses**

Corpses are processed for immediate disposal if an etiological diagnosis has been confirmed.

5.11.1 If a diagnosis has not been established, the minimal specimens described in section 4.3.1.3 (needle "biopsies" of liver and heart blood) are taken and submitted to the Special Pathogens Unit, National Institute for Virology, for the elimination of VHF, irrespective of what specimens have previously been sent for virological examination.
It may be useful for a locally-based histopathologist to examine rapidly fixed (heated formalin) and sectioned liver "biopsy" specimens. Bacterial septicaemia can sometimes be recognized in this way and differentiated from liver disease likely to be due to VHF or other causes. Lack of liver lesions suggests that VHF is not involved.

5.11.2 In terms of the Human Tissue Act 65 of 1983, Chapter 1, Section 8, and subject to the granting of authority, autopsy or removal of organs may be performed "more precisely to determine the cause of death" or for "scientific purposes". In terms of Section 14, the authority for autopsy may be granted by a magistrate or by the medical practitioner in charge of the hospital concerned, i.e. the Medical Superintendent.

After the specimens have been taken, the corpse is processed as described below and removed to be held under refrigeration in the mortuary (if facilities exist) for up to a week or so, while laboratory investigations to eliminate VHF are underway. Once a diagnosis of VHF has been eliminated, it may be deemed safe and/or desirable to proceed with a limited or full autopsy to establish the cause of death.

5.11.3 For disposal, corpses are washed with disinfectant (Chlorocide D 4000ppm, 0.5% sodium hypochlorite, Cidex at standard strength or 2% Tegodor). Orifices are plugged with gauze and puncture sites are taped or sealed (Opsite). The corpse is wrapped in stout plastic shrouds/body bag and sealed. It is advantageous if the body bag/shrouds have an air-valve. The attendants change protective clothing, wash the shrouds/body bag in fresh disinfectant and seal the corpse into a second layer of impervious shrouds/body bag. The process is repeated again and after disinfection of the final layer of shrouds/body bag, the corpse can be removed for storage in the mortuary or placed in a coffin for disposal.

The coffin should be packed with absorbent material (sawdust) which is soaked with disinfectant. Before removal the coffin should be sealed and wiped with disinfectant. Disposal of the body must take place under supervision of the Regional Director of National Health or his representative and should ideally consist of cremation, but supervised burial is acceptable.
5.12 **Discharge of patients**

5.12.1 Provided they are well, Rift Valley fever and Crimean-Congo haemorrhagic fever patients can be removed from strict barrier-nursing conditions, or even sometimes discharged from hospital, two weeks after onset of illness, but they should remain under observation and refrain from strenuous activity for a month or more, depending on their progress. Meningism, encephalitis and ocular lesions are late complications of Rift Valley fever.

It should be added that only severe cases of Rift Valley fever, with haemorrhagic manifestations, are likely to be placed under strict barrier-nursing conditions in the first place. Infection can be gained from blood, but Rift Valley fever is a relatively common zoonosis which does not usually present in severe form and has a low potential for person-to-person spread (see 11.5).

5.12.2 Patients with a diagnosis of any of the other African haemorrhagic fevers should be nursed in isolation for at least 3 weeks after onset of illness. Sexual transmission of Marburg virus in semen has been recorded two months after recovery of the patient and the same could possibly occur with Ebola virus. Excretion of Lassa fever virus in urine has been observed to occur over a period of a few weeks in one patient and the same may well occur with haemorrhagic fever with renal syndrome (HFRS). Isolation and culture of HFRS virus is difficult and erratic, but possibly the discharge of Lassa fever patients from hospital should be made consequent upon failure to isolate virus from three consecutive urine samples collected on separate days.

5.12.3 Recovery from any of the above diseases may be marked by prolonged convalescence and it is advisable that patients should be kept under casual surveillance for about 3 months. They should be warned of the possibilities of their transmitting infection through intimate contact during this time.

5.12.4 Serum samples from recovered patients should be sent for monitoring of antibody response at about monthly intervals during convalescence and patients should be approached about the possibility of donating immune plasma once they are fully recovered. Neutralizing antibody activity appears relatively late in convalescence and plasma collected six months or later after onset of illness appears to be most valuable for therapeutic use.

Plasmapheresis can be arranged at large blood transfusion centres and the plasma should be forwarded to the Special Pathogens Unit, National Institute for Virology, for further processing, testing and storage (see 7.2). Details of the donor's blood grouping should be sent with the plasma. Tests at the National Institute for Virology include screening for antibody levels, hepatitis B markers and the possible presence of infectious VHF viruses in the plasma.
6. **REFERRAL OF PATIENTS**

Frequently, patients have already been transferred through one or more hospitals before VHF is suspected. Once a diagnosis of VHF is suspected or established, decisions to move patients should only be taken after consideration of the following points:

6.1 **Indications for transfer of patients**

6.1.1 The most valid reason for transferring a VHF patient from the initial (primary) hospital to another, is the need for more sophisticated medical care.

6.1.2 A second reason for moving patients is to achieve greater security in isolation and barrier-nursing.

6.1.3 The needs of the patient must be balanced against the availability of facilities: there are stronger grounds for moving moderate or high risk patients to better facilities than there are for moving patients classified as low risk (see 3.4.2). Conversely, low risk patients may be easier to move safely.

6.1.4 The existence of a conveniently located (e.g. regional) facility which has been specifically designated and equipped to receive VHF patients, is an obvious incentive to transfer patients (see 6.4).

6.2 **Contra-indications to transfer of patients**

6.2.1 Patients should not be moved when their condition does not allow this to be achieved safely. Movement may unduly threaten the life of a high risk patient, or involve too great a risk of spreading infection, e.g. when a transport isolator is not readily available.

6.2.2 It is inadvisable to move patients to a distant secondary hospital when a series of cases of VHF arises indigenously, i.e. when there appears to be a continuing local outbreak of undetermined origin.

6.2.3 Likewise, it may be inadvisable to move VHF patients when known contact with the index case has resulted in definite exposure of other people or when secondary cases have already become manifest, as in nosocomial infection (the definition of what constitutes exposure to VHF is given in section 9.2.3.6).

6.2.4 The inference in sections 6.2.2 and 6.2.3 above is that further cases may arise and that transfer of patients would merely result in creating two or more potential centres of infection. (Nursing of VHF patients invariably results in members of medical staff being monitored for suspected infection and this problem is magnified when patients are moved.)
6.2.5 Under certain circumstances, therefore, it is better not to move patients, but to bring to the primary hospital the necessary equipment and even trained staff, required for effective barrier-nursing and patient-care.
6.3 Requirements for handling VHF at regional centres

It is now generally agreed by central and provincial medical authorities that there is a need for designated regional centres to which VHF patients may be referred. The requirements at such centres include:

6.3.1 **Secondary hospital**, i.e. a hospital which has a facility suitable for barrier-nursing of patients (see 5.3) and which has been specifically designated as a secondary hospital for receiving VHF patients (see 6.4).

It is usually possible to improvise or to adapt an existing hospital facility for barrier-nursing with little or no structural alteration.

6.3.2 **Laboratory unit** for monitoring treatment of patients (see 7.3.2).

The laboratory unit need not be in the same complex as the barrier-nursing unit, although this would be an advantage. It is best to use a room in an existing laboratory.

6.3.3 **Quarantine facility** for high risk contact of VHF patients (see 9.3.5).

It is not universally agreed that a quarantine facility is essential. It need not be in the same complex as the barrier-nursing unit.

6.3.4 **Mortuary** with facility for storage of corpses under refrigeration (see 5.11).

This need not be in the same complex as the barrier-nursing unit and should present no problem in an ordinary mortuary provided the corpse is properly wrapped (see 5.11.3).

6.3.5 **Safety equipment** for barrier-nursing and transport of patients (see 5.4.2, 5.4.3, 6.2.5 and 10).

The equipment can be acquired at and made available on loan from selected VHF centres.

6.3.6 **Medical and paramedical teams** for evaluation, transport, treatment, nursing and monitoring of patients (see 5.5, 6.6, 7.3.4 and 8.4.2).

Experienced/trained volunteers could be seconded to any hospital dealing with a VHF patient.
6.3.7. Regional VHF Committee and sub-committees for implementing and overseeing VHF containment and control measures (see 6.5, 8.2 8.3 and 8.4).

The structure and functions of a Regional VHF Committee are discussed in sections 8.2 to 8.4, but it is relevant to stress here that the establishment of such a committee is by far the most important step in creating a regional VHF centre:

On the basis of recent experience it can be estimated that an arbitrary 10 or 11 regional VHF centres distributed throughout the country, could each expect to deal with about 10 suspected cases of VHF per annum, of which one or two could be genuine VHF. Clearly, there is no justification for providing special facilities, staff and equipment which remain permanently dedicated to VHF, and nor are sufficient funds for this purpose likely to be made available.

On the other hand, VHF is a reality and suspected and genuine cases will continue to be transferred, knowingly and unwittingly, to the larger regional hospitals. Hence, it is imperative that there should be some formal provision for dealing with VHF. There is thus a need for facilities, staff and equipment which can be dedicated to VHF at times when there are suspected or genuine cases, and which can be available for routine purposes at other times.

As indicated in sections 6.3.1 to 6.3.6 above, and elsewhere (e.g. sections 5.1 to 5.5, 7.3.4, and 8.2 to 8.4), adequate facilities and resources for dealing with VHF could probably be identified and mobilised without major capital outlay, simply through decisive and harmonious collective action by the various medical and paramedical authorities in a regional centre, i.e. through a Regional VHF Committee. By participating, each medical authority or institution merely acts in its own best interests to evolve an orderly system for coping with VHF in the region, whereas lack of organization and preparedness could otherwise result in chaos.

Of the requirements listed above (sections 6.3.1 to 6.3.6), only the safety equipment (section 6.3.5) is likely to be beyond the means of regional authorities and would need to be budgeted for at a higher level.

Decisions as to which regional centres, and facilities within these centres, should be designated for dealing with VHF patients, rest largely with hospital administrations, but are reached only after due consultation with other relevant organizations, including the Department of Health.
The choice of particular regional centres is dictated by considerations of geography, communications and existing facilities and resources. In most instances the choice is obvious and merely corresponds to larger regional centres where major hospitals already tend to receive suspected VHF patients. The position is more complex in large urban centres where this type of patient tends to be referred to one or other of several large or teaching hospitals with the necessary facilities and resources for sophisticated medical care.

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6.4 Designated secondary hospitals, quarantine facilities and regional laboratories

6.4.1 Outline of referral procedure

Immediately VHF is suspected:
Review the case in committee at the primary hospital and decide whether or not to proceed on the basis that VHF may be involved (see 3.3, 3.4 and 6.5.1 for more details).
Simultaneously, place the patient in preliminary isolation and apply the basic principles of barrier-nursing until further decisions are made (see 3.5.1, 5.1 and 5.6).
Carefully consider the indications for and against transfer of the patient to a secondary hospital (see 6.1 and 6.2).
Arrange transfer of the patient in consultation with the Regional Director of Health Department and Medical Superintendent and relevant clinical staff at the secondary hospital concerned (see 3.5.4 and 6.5.2). This can be done expeditiously by telephone (see directory section).

At present, arrangements are in a state of flux with potential secondary VHF hospitals clearly identified in some regions and still under consideration in others. THE MERE FACT THAT A HOSPITAL OR OTHER FACILITY HAS BEEN NOMINATED FOR DEALING WITH VHF, SHOULD NOT BE REGARDED AS INDICATING THAT A SUITABLE FACILITY ALREADY EXISTS. The information presented here will be updated as circumstances change:

6.4.2 All regions

6.4.2.1 National VHF diagnostic service

The specific viral diagnostic service for VHF is provided for all regions by:

Special Pathogens Unit
National Institute for Virology
Johannesburg

6.4.2.2 National secondary hospital

Provided that secondary cases are considered very unlikely to occur, and that there are no other contra-indications (see 6.2), patients from all regions may be referred to:

Siswe Hospital
Johannesburg
However, the need to transfer patients from other regions to Siswe Hospital should fall away as secondary hospitals elsewhere become functional. It is logical that Siswe Hospital should remain the referral centre of choice for patients with VHF considered likely to be exotic to South Africa.

It should be borne in mind that although Siswe Hospital has safety equipment for barrier-nursing, it is not equipped for intensive care of desperately ill patients.

6.4.3 Western Cape

6.4.3.1 Secondary hospitals

Tygerberg Hospital
Bellville

6.4.3.2 Quarantine facility

City Hospital for Infectious Diseases
Cape Town

6.4.3.3 Clinical pathology laboratory

Clinical Pathology Departments
Tygerberg Hospital
Bellville

Advice and assistance in obtaining an aetiological diagnosis of VHF, and liaison with the National Institute for Virology, is provided by:

Clinical Virology Laboratory of:
Regional Health Laboratory Services
and Faculty of Medicine,
University of Cape Town

6.4.4 Eastern Cape

6.4.4.1 Secondary hospitals

Provincial Hospital
Port Elizabeth
Clinical cover will be provided jointly by staffs of Livingstone and Provincial Hospitals.
6.4.4.2 Quarantine facilities
Elizabeth Donkin Hospital
Port Elizabeth
Empilweni Hospital
Port Elizabeth

6.4.4.3 Clinical pathology laboratory
Regional Laboratory
South African Institute for Medical Research Port Elizabeth

6.4.5 Border

6.4.5.1 Secondary hospital
Frere Hospital
East London

6.4.5.2 Quarantine facility
Infectious Diseases Hospital (adjacent to Frere Hospital)
East London

6.4.5.3 Clinical pathology laboratory
Pathology Laboratory
Regional Health Laboratory Services
Frere Hospital
East London

6.4.6 North-Western Cape

6.4.6.1 Secondary hospital and quarantine facility
Kimberley Hospital
Kimberley

6.4.6.2 Clinical pathology laboratory
Regional Laboratory
South African Institute for Medical Research Kimberley

6.4.7 Orange Free State

6.4.7.1 Secondary Hospitals
National Hospital
Bloemfontein
Pelonomi Hospital
Bloemfontein
6.4.7.2 **Quarantine facilities**

At the above secondary hospitals

6.4.7.3 **Clinical pathology laboratories**

Clinical pathology departments of:
O.F.S. Department of Hospital Administration and Faculty of Medicine,
University of the O.F.S. Universitas Hospital
Bloemfontein

Liaison with the National Institute for Virology and advice and assistance in obtaining an aetiological diagnosis:

Department of Virology of:
O.F.S. Department of Hospital Administration and Faculty of Medicine,
University of the O.F.S. Universitas Hospital
Bloemfontein

6.4.8 **Natal**

6.4.8.1 **Secondary hospitals**

Grey's Hospital
(St. Anne's Hospital)
Pietermaritzburg
Clairwood Hospital
Durban

6.4.8.2 **Quarantine facility**

Not yet designated.

6.4.8.3 **Clinical pathology laboratories**

Clinical pathology departments of:
Regional Health Laboratory Services
King Edward VIII Hospital
Durban

The above Regional Laboratory will arrange for clinical pathology tests to be conducted within, or close to, primary or secondary hospitals which are engaged in treating confirmed VHF patients.
Advice and assistance in making an aetiological diagnosis and liaison with the National Institute for Virology can be provided by:

Department of Virology of:
Regional Health Laboratory Services
and Faculty of Medicine, University of Natal
King Edward VIII Hospital
Durban

6.4.9 Southern Transvaal

6.4.9.1 Secondary hospitals

Siswe Hospital
Johannesburg

In addition to serving as a national (and international) referral hospital for VHF, Siswe Hospital serves more specifically as a regional secondary hospital for a large part of the Transvaal and the northern parts of Natal and the Orange Free State.

Siswe Hospital lacks intensive care facilities and local and foreign patients are sometimes referred to:

Johannesburg Hospital
Johannesburg

6.4.9.2 Quarantine facility

Siswe Hospital
Johannesburg

6.4.9.3 Clinical pathology laboratory

Department of Tropical Diseases
South African Institute for Medical Research Hillbrow
Johannesburg

6.4.10 Pretoria-Medunsa teaching hospitals area

6.4.10.1 Secondary hospitals

H.F. Verwoerdt Hospital
Pretoria
Ga-Rankuwa Hospital
Ga-Rankuwa
6.4.10.2 **Quarantine facilities**

Quarantine facilities are apparently available at the above two hospitals.

6.4.10.3 **Clinical pathology laboratories**

Clinical Pathology Departments of:

Institute for Pathology  
Faculty of Medicine, University of Pretoria  
Pretoria

Faculty of Medicine  
Medical University of South Africa  
Ga-Rankuwa

Advice and assistance in making an aetiological diagnosis and liaison with the National Institute for Virology can be provided by:

Department of Medical Virology  
Institute for Pathology  
Faculty of Medicine  
University of Pretoria  
Pretoria

Sub-department of Virology  
Department of Microbiological Pathology  
Faculty of Medicine  
Medical University of South Africa  
Ga-Rankuwa

6.4.11 **South African Medical Services**

6.4.11.1 **Secondary hospital**

1 Military Hospital  
Thaba Tshwane  
Pretoria

6.4.11.2 **Quarantine facility**

Will vary with circumstances.

6.4.11.3 **Clinical laboratory**

1 Military Hospital Laboratory  
Thaba Thswane  
Pretoria
6.5 **Reaching a decision on transfer of patients**

Decisions on whether or not to transfer patients are reached with greatest facility where a framework for consultation has been organised as a matter of preparedness:

6.5.1 At the level of individual hospitals there should be small standing committees for initial clinical evaluation of suspected cases of VHF (see 3.3 and 8.4.2). This would include the Medical Superintendent, the medical officer responsible for infection control/infectious diseases and such relevant consultants in internal medicine, infectious diseases and other disciplines as may be available. Outside opinion may be sought per telephone. A decision should be reached as to whether indications for seeking transfer of the patient outweigh any contra-indications (see 6.1 and 6.2).

6.5.2 The next step is to consult a member of the regional sub-committee which deals with transfer of patients. Such a sub-committee should include the Regional Director of Department of Health, the Medical Superintendent/s of designated secondary VHF hospital/s in the region and heads and senior members of clinical department/s who are ultimately responsible for the care of VHF patients in secondary hospitals.

In practice, and particularly in emergency situations, the official at a primary hospital who is seeking transfer of a patient, should only need to contact per telephone one member of the regional sub-committee for transfer of patients. Logically, this member should be a senior clinician of the team responsible for medical care of VHF patients in a designated VHF hospital. In dire emergency, this official can make an instantaneous decision concerning transfer of the patient and then inform the rest of the sub-committee of the decision through normal channels of command, i.e. through the head of the clinical section.

Ordinarily, members of the sub-committee should consult, by telephone if necessary, before reaching a decision on transfer of the patient. The various options should be explored, including nursing of the patient/s at the primary hospital, transfer to a secondary hospital or transfer to Siswe Hospital. This latter option will require consultation with the Medical Superintendent of Siswe Hospital, who in turn will discuss the matter with the Director of Medical Services at the headquarters of the Department of Health.

In any event, it has been found that decisions can be reached with suitable expediency by telephone consultations.
Immediately the decision to transfer a patient has been reached, it should be known or made known to all members of the regional sub-committee and in turn these officials should inform those subordinate and superior officers who have need of the information: the Medical Superintendent of the secondary hospital informs the Director of the relevant hospital administration, heads of clinical departments inform ward staff to set in motion necessary preparations for receiving patients and the Regional Director of Department of Health informs his staff and the Director of Medical Services at headquarters. Where VHF patients are being transferred to another region, it is a matter of importance and courtesy to inform the Regional Director of that region.
Transport of VHF patients

It is a widely held misconception that the movement of VHF patients inevitably involves the use of special transport isolators and aircraft. In practice, this is seldom the case and much depends on the condition of the patient, the distance and terrain to be covered and the nature of the resources which are available.

Transport requirements fall into three categories:

6.6.1 Local transport of VHF patients

It is self-evident that before the possibility of a diagnosis of VHF is recognized, patients are usually transported to doctors' rooms or to local hospitals without special precautions being taken to limit spread of infection. Once VHF is suspected, it is necessary to take precautions. However, there is generally room for judicious improvisation in transporting patients in the early stages of the disease. For instance, when febrile illness first occurs in a known VHF contact, there appears to be no valid objection to the patient being taken to a doctor or to hospital in the vehicle of a relative with whom the patient has already had close contact. The safety of those in attendance should nevertheless remain a prime consideration and patients who are severely ill, or who are vomiting or manifesting haemorrhagic signs, should not be transported in this manner. In such circumstances it becomes necessary to use a trained VHF transport team as indicated in the next section (6.6.2).

6.6.2 Regional transport of VHF patients

In the majority of instances, the possibility of VHF is only recognized after a patient has been admitted to a hospital and transport is then required for transfer of the patient within the region to a secondary hospital which has been specifically designated for the treatment of VHF patients (see 6.4 and the directory section at the end of this document).

The transfer of a known or suspected VHF patient to a designated secondary hospital must be negotiated with a senior member of the VHF clinical team or the Medical Superintendent of the secondary hospital, plus the Regional Director of National Health and Population Development (see 6.4.1). These officials decide on appropriate arrangements for the transport of the patient and make contact with the transport team.

Ordinarily, patients should be transported by trained personnel based at the regional VHF centre, using protective clothing and such equipment as may be deemed necessary for safe conveyance of the patients in standard ambulances (see section 6.6.4).
6.6.3 **Long distance transport of VHF patients**

In circumstances where suspected or confirmed cases of VHF occur in remote and inaccessible locations and/or patients need to be transported over long distances to appropriate hospitals, special arrangements to convey the patients by aircraft may be warranted. This may involve the use of a transport isolator, not only for reasons of safety, but also to obviate the need to decontaminate a series of vehicles, e.g. ambulance - aircraft - ambulance.

The use of transport isolators with aircraft is an expensive and skilled operation. At present only two centres have the necessary equipment and trained personnel:-

- Siswe Hospital, Johannesburg (directory page T20)
- Metro Control, Emergency Services Centre, Cape Town (directory page T35)

All requests for long distance transport of VHF patients should be directed to either of these two centres. Officials at these centres will obtain the necessary clearance from the Department of Health, arrange for suitable aircraft to be made available and will co-ordinate all other aspects of the operation, such as surface transport at either end of the air journey.

6.6.4 **Organisation and operational procedure of regional VHF transport teams**

6.6.4.1 VHF transport teams composed of volunteer personnel should be established at each of the designated regional centres. The teams should be under the control of specific individuals to whom all requests for transport of patients should be channelled by members of the VHF clinical teams at designated secondary hospitals. The officials controlling the transport teams may be based either at the secondary hospitals or at separate ambulance or emergency services centres, but in any event proper channels should exist for communication and co-operation between transport and clinical teams.

6.6.4.2 Ambulance personnel should be trained in recognition of VHF, assessment of the condition of patients (see 3.1, 3.2 and 3.4) and essential barrier-nursing techniques, including the use of Vickers Model 94 respirators (see 5.7, 5.8 and 10.1.3) for protection of attendants when high risk patients are involved (see 3.4.2).
6.6.4.3 VHF transport centres should keep stocks of protective clothing available, preferably in conveniently packaged form such as the formidable epidemic disease (FED) packs used in Cape provincial hospitals (see 5.4.2). An ambulance which is despatched to transport a case of suspected or confirmed VHF should carry 10 packs each containing:

- Disposable gown 1
- Balaclava type cap 1
- Dust goggles 1
- Disposable plastic aprons 2
- Theatre masks, moulded 2
- Surgical gloves 2 pairs
- Overshoes 2 pairs

In addition, there should be 2 packs each containing:

- Refusaks 10
- Red Plastic bags 10
- Biocide D (see 5.9.11) 50 sachets
- Biohazard labels
- Felt tip pen

Secondary hospitals should further make available 2 Vickers respirators to the ambulance crew when high risk patients are to be transported.

Although the ambulance should be stripped of non-essential equipment, it should carry a suction unit, a complete oxygen supply unit and the standard range of equipment for treatment of patients. All items should however, be sealed into plastic bags with adhesive tape and only opened if required.

6.6.4.4 The contact persons at the regional hospital should ascertain the condition of the patient to be transported and advise the ambulance team of the appropriate protective measures to be taken, e.g.:

- Conscious patient, no vomiting, no active visible haemorrhage, in full control of urinary bladder and bowel function - ambulance crew to use protective clothing as contained in FED pack.

- Patient with disturbed level of consciousness, vomiting, possible haemorrhage or pulmonary involvement, not in control of urinary bladder or bowel functions - Vickers respirators to replace masks, goggles and balaclava cap.
6.6.4.5 A minimum ambulance crew of 3 people is required for transport of VHF patients. On arrival at the location of the patient, the crew should re-assess his/her condition and if necessary consult the clinical team at the regional hospital per telephone if there has been marked deterioration. The 3 crew members should all don protective clothing, but the driver should avoid contact with the patient and supervise transfer of the patient into the ambulance by the other 2 crew members and local hospital staff who have already had contact with the patient. Five of the FED packs should be carried in the driver's compartment and these should be made available to the personnel at the referring hospital for use in transferring the patient and in decontaminating afterwards. Information on hospital decontamination procedures can be found in this document, which has been sent to all provincial and province-assisted hospitals (see 5.9 and 5.10), or can be ascertained per telephone from the regional secondary hospital.

Patients must be brought by wheeled bed or hospital trolley to the ward entrance and then transferred to the ambulance stretcher to minimize further contamination of the hospital. Passages should be kept clear during transit of the patient through the hospital.

The receiving hospital should be given an estimated time of arrival by the ambulance crew and the patient should be taken by shortest route to the appropriate ward through passages which are kept clear during the transit.

6.6.5 **Decontamination of ambulance and disposal of hazardous items**

A senior individual should be responsible for supervising decontamination and disposal procedures.

After transport of a patient, vomitus, blood and other spillages should be flooded with biocide D (see 5.9.1.1), covered with paper towels and the ambulance sealed for a minimum of 2 hours before further steps are taken.

Persons cleaning the ambulance should don protective clothing (2 FED packs should still be available from the original 10).

All items leaving the ambulance should be enclosed in sealed bags and the outer surfaces of the bags should be wiped with Biocide D (500 ppm). It may be necessary to use several layers of bags for safety and the outer bag must be red and labelled to indicate that the parcel contains biohazardous material.

Disposable items should be sent for incineration under supervision and re-usable items for autoclaving.
Containers with secretions, excretions and other wastes such as vomitus and blood, should be treated with Biocide D (4000 ppm) for at least 30 minutes and then placed in a leak-proof autoclave bag or other secure secondary container (e.g. stainless steel container) before removal for autoclaving and cleaning. Autoclaved wastes can be flushed into municipal sewers. After flushing, bedpans are cleaned with Biocide D (2000 ppm).

Otherwise, thoroughly disinfected wastes (prolonged exposure to copious disinfectant) should be discarded into sealed disposal pits or buried.

Vinyl, certain rubber and other items which would be degraded by autoclaving should be discarded and incinerated or washed in Biocide D (500 ppm).

Sharp instruments, particularly hypodermic and intravenous needles, should be used with great care. Used needles should be discarded into rigid-walled containers and sent for incineration. Dispensaries are a good source of suitable containers.

Used linen and cloth items of protective wear should be autoclaved, but consideration should be given to merely incinerating grossly contaminated items such as bloodstained mattresses and pillows and blankets.

Finally the ambulance interior should be swabbed down, including fittings, with Biocide D (500 ppm) and all unused equipment removed from the sealed bags and the bags incinerated.
TREATMENT AND MONITORING OF VHF PATIENTS

The treatment of VHFs is essentially supportive, but varies with the stage and severity of illness. It is a subject on which it is difficult to obtain consensus of opinion and detailed analysis lies beyond the scope of the present document. The following remarks represent an attempt to summarise experience gained in treating Crimean-Congo haemorrhagic fever (CCHF) in this country over the past few years.

7.1 Supportive treatment

7.1.1 Monitoring of vital functions should include temperature, pulse and respiration rates, chest auscultation and fluid balance (liquid intake/urinary output).

The necessity for and frequency of additional monitoring is dictated by the severity of the disease/condition of the patient and whether or not a ventilator and drugs such as diuretics are being used. Tests include full blood counts (with platelet plus haemoglobin values), coagulation, liver function, glucose, creatinine, urea, electrolyte, blood gases and pH determinations on appropriate blood samples.

If possible, a chest X-ray should be taken on admittance of the patient and repeated if respiratory distress or suspected secondary infection occurs.

7.1.2 Haemoglobin replacement may be considered when blood levels fall to 8-10g/dl, but some patients tolerate such low levels quite well: it is more important to treat on the basis of signs and symptoms of anaemia (respiratory distress etc) than purely on haemoglobin levels.

Although fresh blood may be transfused, it is better to use red blood cell concentrate to treat the anaemia of VHF. This helps prevent fluid overload and development of the respiratory distress syndrome. Moreover, modern additives to red cell concentrate, such as "Adsol", adequately maintain the levels of 2,3-diphosphoglycerate and the other phosphates which modulate the oxygen affinity of haemoglobin, so it is not essential to use fresh blood. As a rough guide, one unit of red cell concentrate should raise the haemoglobin level of an average adult by 1g/dl.

7.1.3 Contrary to our earlier perceptions, disseminated intravascular coagulopathy (DIC) appears to be a prominent feature of CCHF.

There are two schools of thought on treatment of DIC: one holds that the administration of coagulation factors merely "adds fuel to the fire", while the other advocates judicious replacement of coagulation factors. The latter appears to be most widely favoured.
7.1.4 The use of heparin in treatment of DIC is controversial. It is useful in the hypercoaguable stage [accelerated partial thromboplastin time (PTT) and decreased prothrombin ratio (PR)] of early DIC, but is of no value once the fibrinogen level falls. Moreover, the use of heparin is a skilled operation which needs constant monitoring of response and it is best avoided by those inexperienced in dealing with acute haemostatic failure.

7.1.5 Thrombocytopaenia is a common feature of VHF's and occurs regularly in CCHF. There is agreement on the need for replacement of platelets, but this should be done only if thrombocytopaenia is accompanied by purpura and active bleeding such as epistaxis, or if platelet counts fall below 20X10^4/µl.

A bag of platelet concentrate contains approximately 0.5 - 1.0X10^4 platelets in about 50 ml of plasma. The dosage of platelet concentrate is 1 bag/10kg body mass and transfusion services can be requested to pool the total dose, e.g. 7 bags can be supplied as 1 bag of 350 ml which can be administered rapidly (10 minutes). Transfusion services ordinarily supply platelets of appropriate ABO group specificity. The treatment may be repeated over a period of days if the patient's platelet level continues to decline or remains critically low.

7.1.6 If there is manifest consumption of other coagulation factors (abnormal PTT and PR; fibrinogen level < 0.8g/l), administer fresh frozen plasma (FFP) or fresh dried plasma (FDP) at the rate of 10ml/kg body mass for the first dose. The treatment may be repeated if the patient continues to bleed or if coagulation factor levels remain markedly abnormal.

As a general rule, 2-3 units of FFP or FDP should be administered to augment coagulation factors for every 10 units of red cell concentrate given to the patient.

Fibrinogen is no longer prepared separately in South Africa, but apart from administering it in FFP and FDP, it and other factors can also be administered in the form of cryoprecipitate. One bag of wet cryoprecipitate contains about 250 mg of fibrinogen and a bottle of dried cryoprecipitate [anti-haemophilia factor (AHF)] is derived from a pool of 4-6 units of wet cryoprecipitate and contains approximately 1 g of fibrinogen. About 1-2 g fibrinogen (10 bags of wet cryoprecipitate) may be administered as a first dose.

Prothrombin complex concentrate (PCC)(factor IX complex, Proplex) may be indicated following liver damage. It is supplied by the Natal Blood Transfusion Service (P O Box 2356, Durban 4000, Telephone 031-784311) and contains 200 units factor IX in 10 ml volume. A dosage of 1 U/kg should increase the blood level of the factor by approximately 1%. Vitamin K should also be administered.
7.1.7 It should be noted that plasma is used to replace coagulation factors, not merely for volume expansion. Iso-osmotic albumin solution (4%) may be used for volume expansion.

Although 20% albumin has been used to treat hypoproteinaemia following liver damage in CCHF, it is considered better to use balanced parenteral feeding or to feed a low fat, high protein liquid diet per os.

7.1.8 Hypoglycaemia was thought to be of critical importance in a number of CCHF patients in South Africa and blood glucose levels should be monitored carefully in severely ill patients.

7.1.9 Transfusion of leukocytes and use of steroids are not recommended. Antacids, pain-killers, relaxants and tranquillizers are administered as indicated.

Antibiotics are used only if there is evidence of secondary bacterial infection, and only after blood cultures have been taken.

7.2 Immune plasma and antiviral therapy

7.2.1 Immune plasma
Limited stocks of immune plasmas to the various African VHF s are kept at the National Institute for Virology (see page T39 of the directory section). Anti-CCHF plasma units are also kept at the S A Blood Transfusion Service in Kimberley (P O Box 722, Kimberley, 8300, Tel. 0531-31651) and at Tygerberg Hospital (see page T1 of the directory section).

Since the plasma is in short supply, it should only be used where a clinical diagnosis has been made with a fair degree of certainty and where there appears to be a real need for such therapy: patients who have already developed an antibody response are unlikely to benefit from the administration of immune plasma. Unused units should be returned to the supplier.

It should be noted that there is no controlled experimental evidence to confirm that the administration of immune plasma is of benefit in CCHF. On first principles, it would seem that the administration of large amounts of immune plasma, or purified immunoglobulins, would be beneficial. However, since the immune plasma is in short supply, it is suggested that one 250 ml unit is administered initially and that this is repeated on successive days as appears to be indicated.

7.2.2 Interferon
Little is known of the value of interferon therapy in VHF s, but the drug makes patients feel unwell and clinicians are consequently averse to using it. It has been shown that high levels of interferon are attained naturally in the sera of Lassa fever patients.
7.2.3 Antiviral compounds

Ribavirin (Virazole: Viratek, 3300 Hyland Ave, Costa Mesa, Calif. 92626, USA) is a synthetic nucleoside analogue which is in experimental use as an antiviral compound, i.e. it is not a registered drug, except for limited usages in the USA. It has been shown to be of use in treating Lassa fever patients in West Africa. The only report on its use for treating persons exposed to CCHF, during a nosocomial outbreak, was inconclusive. Permission has been obtained from the Medicines Control Council for a trial to be conducted with ribavirin for treatment of CCHF patients by physicians at Kimberley Hospital. Use of the drug elsewhere would have to be cleared with the Medicines Control Council. The local agents for the drug are Continental Ethicals, P O Box 55307, Northlands 2216 and Mr G. Pienaar of the firm may be contacted per telephone at work: (011) 788 5084, or at home: (011) 705 2843.

The recommended dosage is 17 mg/kg (maximum 1 g) intravenously every 6 hours for 4 days followed by 8 mg/kg (maximum 0.5g) every 8 hours for 6 days.

7.3 Clinical laboratory monitoring of patients

7.3.1 Tests

At a regional VHF centre there should be a laboratory unit suitable for performing:-

7.3.1.1 Screening tests to eliminate non-VHF diseases in suspected cases of VHF (see 4.2). A minimum range of tests should include:-

- Full blood count
- Examination of blood smear for parasites
- Blood cultures for septicaemia

7.3.1.2 Essential haematological and clinical chemistry tests for monitoring the treatment and progress of patients as detailed under 7.1.1 above.

7.3.1.3 Cross-matching and other essential tests related to transfusion.

7.3.2 Staff and laboratory unit

The tests should be performed by suitably experienced volunteer staff in a room which can be set aside for the purpose within an existing laboratory. It is an advantage if the laboratory is in the same complex as the barrier-nursing unit, but this is not essential provided that it is within easy reach. (In ideal circumstances a small laboratory unit could be equipped within a secondary hospital, but specific expenditure for this purpose is difficult to justify in view of the sporadic occurrence of VHF.)
The room should open into an area to which access is controlled, i.e. not open to the public or non-laboratory staff. If there is air-conditioning, it should ideally meet the criteria set out in 5.3.5.

The staff should use protective clothing as detailed in 5.7 and 5.8 and ideally all manipulations should be performed in a safety cabinet of the biohazard laminar flow variety (class IIA).

The room, contents and test materials should be decontaminated by an appropriate method as discussed in sections 5.9 and 5.10. The room and equipment can be available for routine laboratory purposes when VHF patients are not under investigation.

7.3.3 Specimens

The specimens taken daily for clinical monitoring of VHF patients include:

- Clotted blood sample
- Blood taken with EDTA (sequestrene) anticoagulant
- Blood taken with citrate anti-coagulant
- Blood taken with other preservatives as required (see 7.1.1)

A separate clotted blood sample is taken daily for submission to the National Institute for Virology to monitor specific antibody response.

The specimens (properly labelled) are sealed into a double layer of clear plastic bags in the patient isolation facility. The parcel is marked with a biohazard sticker in the anteroom to the patient's room and the outer surface is disinfected (see 5.10.1). If the specimen is not being taken directly to a laboratory within the same complex, it should be placed in a cold box (with cold packs if the journey takes more than an hour). The cold box should be marked with a biohazard sticker and/or prominent warning that it should not be opened except in the specified laboratory unit.

7.3.4 Monitoring of laboratory staff

Laboratory staff should be subject to the same monitoring as all other medical staff dealing with VHF patients (see 5.5.6).
8. ADMINISTRATIVE CONSIDERATIONS

8.1 Responsibilities of the Regional Director of National Health and Population Development

The Department of National Health and Population Development is ultimately responsible for containment and control of VHF in the community. This control is exercised through the office of the Regional Director. During outbreaks of VHF the responsibilities of this official would therefore include:

8.1.1 Co-ordinating laboratory and autopsy investigations to establish an aetiological diagnosis, i.e. ensuring that the correct specimens are submitted to the appropriate laboratory (see 4.2, 4.3, 5.10 and 7.3).

8.1.2 Participating in decisions and arrangements to transfer patients to Siswe Hospital or to another hospital (see 6.5).

8.1.3 Ascertaining that patients are treated under conditions of isolation and barrier-nursing (see 5.1 to 5.8).

8.1.4 Controlling and approving the financial commitment of the Department of National Health and Population Development with regard to transport and care of VHF patients and other contingency expenditure, subject to the constraints imposed by delegation of authority within the Department.

8.1.5 Investigating the source of an outbreak.

8.1.6 Tracing and observation of contacts (see 9.2 and 9.3).

8.1.7 Supervising disposal of corpses (see 5.10).

8.1.8 Collating information and disseminating it to those who need to be kept informed, e.g. see sections 9.1.1 and 9.1.2.

8.1.9 Any other action commensurate with attaining containment and control of VHF. The list is not intended to be exhaustive or definitive, but merely to indicate that the functions of the Regional Director extend across the fields of competence of other authorities and that success can only be achieved through willing co-operation between the authorities. In practice, no difficulties have been encountered in obtaining such co-operation.
8. **ADMINISTRATIVE CONSIDERATIONS**

8.1 **Responsibilities of the Regional Director of Department of Health**

The Department of Health is ultimately responsible for containment and control of VHF in the community. This control is exercised through the office of the Regional Director. During outbreaks of VHF the responsibilities of this official would therefore include:

8.1.1 Co-ordinating laboratory and autopsy investigations to establish an aetiological diagnosis, i.e. ensuring that the correct specimens are submitted to the appropriate laboratory (see 4.2, 4.3, 5.10 and 7.3).

8.1.2 Participating in decisions and arrangements to transfer patients to Siswe Hospital or to another hospital (see 6.5).

8.1.3 Ascertaining that patients are treated under conditions of isolation and barrier-nursing (see 5.1 to 5.8).

8.1.4 Controlling and approving the financial commitment of the Department of Health and Population Development with regard to transport and care of VHF patients and other contingency expenditure, subject to the constraints imposed by delegation of authority within the Department.

8.1.5 Investigating the source of an outbreak.

8.1.6 Tracing and observation of contacts (see 9.2 and 9.3).

8.1.7 Supervising disposal of corpses (see 5.10).

8.1.8 Collating information and disseminating it to those who need to be kept informed, e.g. see sections 9.1.1 and 9.1.2.

8.1.9 Any other action commensurate with attaining containment and control of VHF. The list is not intended to be exhaustive or definitive, but merely to indicate that the functions of the Regional Director extend across the fields of competence of other authorities and that success can only be achieved through willing co-operation between the authorities. In practice, no difficulties have been encountered in obtaining such co-operation.
8.2 **Initiation and structure of a Regional VHF Committee**

It follows from section 8.1.9 that the Regional Director of Department of Health, or his nominated deputy in a designated regional VHF centre (see 6.3.7 and 6.4), should convene, by invitation, a Regional VHF Committee which includes his own staff and for example:-

8.2.1 Medical Superintendents and Secretaries of designated secondary hospitals and quarantine facilities (see 6.4). These officials also represent the Director of Hospital Services of the administration concerned and keep him/her informed of developments.

8.2.2 Infectious disease control officers and senior nursing personnel from the above hospitals.

8.2.3 Consultants/Professors in Internal Medicine, Infectious Diseases, Microbiology, Virology, Haematology, Clinical Pathology/Chemistry, Histopathology and other relevant disciplines as may be available.

8.2.4 The Medical Officer of Health and other health officials of the Local Authority or Authorities concerned.

8.2.5 Heads of other independent organizations and services as may be relevant, such as medical laboratories, mortuaries, ambulance, and blood transfusion services.

8.2.6 Any other official considered to be relevant. The list is not intended to be exhaustive and definitive.

As discussed in sections 8.4 and 8.5 not all officials need be involved in all meetings and activities of the Regional VHF Committee. It is possible for the Committee to consist of a nucleus of essential officials and to co-opt members as and when required. For instance, it may be useful to co-opt veterinary officials during investigation of a zoonosis.

8.3 **Functions of the Regional VHF Committee**

In broad terms, the functions of a Regional VHF Committee coincide with those enumerated for the Regional Director of National Health and Population Development: to contain and control VHF (see 8.1). However, these functions must be divided into two categories:-

8.3.1 **Forward planning**: to identify facilities and resources for VHF control, to draw up detailed contingency plans, to institute training programmes as necessary and to assign responsibilities.

8.3.2 **Control outbreaks**: to institute and co-ordinate contingency plans during actual outbreaks.
The role of the Regional VHF Committee in forward planning.

8.4.1 In the absence of actual outbreaks of VHF, the Regional VHF Committee need only meet occasionally to plan, institute and review preparations for handling VHF in the region. As mentioned in section 8.2.6 above, routine administration can be handled by a streamlined Executive Committee which includes only key officials from the various organisations concerned, or can even be managed by an executive official.

8.4.2 In practice, the Regional VHF Committee achieves most of its purposes through a series of de facto sub-committees which operate within their own institutions and fields of competence and report through their normal chains of command to the Executive Committee. The number and composition of sub-committees required varies with regions, but should cover all aspects of preparation needed for containment and control of VHF:

8.4.2.1 Securing facilities, supplies and logistics (see 5.3, 5.4 and 6.3).
8.4.2.2 Training of staff in recognition and evaluation of suspected cases of VHF (see section 3).
8.4.2.3 Training of staff in transport of VHF patients (see 6.6).
8.4.2.4 Training of staff in barrier-nursing techniques and care of VHF patients, and so forth (see section 5).

Senior clinicians and nursing staff at a designated secondary hospital, for instance, would constitute a sub-committee responsible for training of staff in barrier-nursing techniques, ambulance crews and officials would organise a VHF patient transport service while administrators would be instrumental in securing facilities, supplies and logistics.

8.4.3 Quite aside from the need for organisation and preparation at regional VHF centres, it is important that medical institutions of any sort, including private practices, are well-informed and have contingency plans of their own for dealing with suspected cases of VHF. Specific responsibilities should be delegated and all personnel should be in a position to act from a precise and pertinent set of instructions (see sections 3 and 5). Here too, the Regional VHF Committee has a role to play in disseminating information and monitoring awareness.
8.5  The role of the Regional VHF Committee in controlling outbreaks of VHF.

8.5.1 As discussed in section 9.1.2, the response to a VHF alert should be graded according to the degree of certainty with which VHF has been diagnosed. Once VHF is confirmed, the Regional Director of the Department of Health should convene and chair a VHF Outbreak Management Committee. It should be based at the hospital involved and may need to meet twice daily at the height of a VHF outbreak. This ad hoc sub-committee of the permanent Regional VHF Committee is so constituted as to monitor and review:-

8.5.1.1 Clinical management of the patient/s, including decisions to transfer patients (see 6.5, 7.1 and 7.2).

8.5.1.2 Transport of patients, specimens or equipment and any other form of logistical support, particularly when approval of expenditure or the use of hospital facilities is required (see 6.6 and 8.1.4).

8.5.1.3 Control of infection, including location of haematological, biochemical and bloodbank support services and disposal of infected materials (see 5 and 7.3).

8.5.1.4 Tracing and observation of contacts inside and outside the hospital (see section 9).

8.5.1.5 Provision of up-to-date information to all officials, staff members and organisations involved in the outbreak, the patient's relatives and the public. In this regard, the Committee should approve and release regular press statements as deemed necessary (see 8.6).

8.5.2 THE ESSENTIAL PURPOSE OF AN OUTBREAK MANAGEMENT COMMITTEE IS TO ENSURE THAT NO FUNDAMENTAL STEPS OR PROCEDURES ARE OVERLOOKED AND TO ACT DECISIVELY TO END THE STATE OF CRISIS WHICH ENSUES IN GENUINE OR SUSPECTED OUTBREAKS OF VHF.

8.5.2.1 To this end, the Committee should work according to a pre-determined checklist and should make records of all its meetings and actions. The records should be reviewed by the permanent Regional VHF Committee at the end of the outbreak with a view to bringing about any necessary improvements in facilities or procedures for the future.

8.5.2.2 An example of a situation calling for decisive action by an Outbreak Management Committee is the impasse which is sometimes reached when virus laboratory tests tend to eliminate a diagnosis of VHF, yet there is reluctance either to pursue efforts to establish an alternative diagnosis, e.g. through autopsy, or to declare the crisis at an end.
Communication with the media

Communication with the media should be run on an organised basis. The media can be highly disruptive during outbreaks of VHF through disseminating incorrect and alarmist information and through constantly badgering officials who can ill afford the loss of time.

8.6.1 The disruption which may be caused by the media is best countered by issuing factual, non-sensational statements through a specially appointed spokesman for the committee or organisation concerned, once occurrence of the outbreak is known to the media. Spokesmen or committees should confine themselves to their area of competence and should not pass on information to media which has not been made known to those who need to be informed first, e.g. it would be unacceptable for clinicians to hear of laboratory findings first on the radio, or for officials of the Department of Health to learn of an outbreak of VHF in the press.

8.6.2 The following has been suggested as a guideline for communicating with the media:

<table>
<thead>
<tr>
<th>Spokesman for:</th>
<th>Main area of competence:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Health</td>
<td>National status/policy</td>
</tr>
<tr>
<td>National Institute for Virology</td>
<td>Background to VHF's</td>
</tr>
<tr>
<td>VHF Outbreak Management Committee</td>
<td>Status of outbreak*</td>
</tr>
<tr>
<td>(of the Regional VHF Committee)</td>
<td>Status of patient/s.*</td>
</tr>
</tbody>
</table>

* The VHF Outbreak Management Committee may choose to make separate spokesmen available to the media:

- the Regional Director of National Health and Population Development or a member of his staff for dealing with the status of the outbreak;
- the Medical Superintendent of the primary or secondary hospital concerned, or a senior member of the VHF clinical team, for dealing with the status of the patient/s.

8.6.3 Although it is in order to issue approved press statements at set times, it is still advisable to have a well-informed spokesman available to the media. Refusing to communicate or withholding information does not remove misconceptions. By the same token, staff should not volunteer information to outsiders or to the media. Most suspected cases of VHF turn out not to be VHF and it is pointless to have routine investigations constantly interrupted by the media.

8.6.4 The right of patients to preserve their privacy and anonymity should be respected.
8.7 Conclusion

It is as well to remember that VHF pales into insignificance as a medical problem when compared to measles, tuberculosis or even poliomyelitis. No officials or medical personnel should be called upon to devote a great deal of their year to VHF. Yet, to minimise the disproportionately disruptive effects of suspected or genuine VHF outbreaks, some time should be devoted to contingency planning. The development of a proper administrative infrastructure with functional channels of communication and set procedural guidelines, is by far the most important requirement for successful control of VHF at national, regional or even individual hospital level.
9. NOTIFICATION OF VHF AND OBSERVATION OF CONTACTS

9.1 Notification

9.1.1 Legal requirement

The VHF are notifiable diseases in terms of Regulation 1802 of 24 August 1979 promulgated under Section 45 of the Health Act 65 of 1977. In essence, the clinician in charge of a case at the time that an etiological diagnosis is established, is responsible for reporting the case to the Director-General of National Health and Population Development. This usually takes place through a channel of communication which ensures that the information reaches all who have need of it. The clinician reports the case to the medical authority in charge of his/her institution (if he/she is not the same person). This official, usually the Medical Superintendent of a hospital, makes the case known to the Regional Director of National Health and Population Development. Non-hospitalised cases are reported to the local Medical Officer of Health, who in turn reports to the Regional Director of National Health and Population Development. The Regional Director reports to the Director, Medical Services and the Director, Epidemiology, at the headquarters of the Department of National Health and Population Development. The Regional Director also ensures that the information reaches local officials who need to be kept informed, e.g. the local Medical Officer of Health and other members of the Regional VHF Committee.

9.1.2 Practical considerations in the notification of VHF

In practice, there is need for a graded response to suspected VHF: the potentially grave consequences of failing to take timely and appropriate measures must be weighed against the inconvenience and costly disruptions caused by false alarms. Hence, three grades of notification are envisaged:

9.1.2.1 A possible case of VHF

In patients of this type VHF is under consideration as a differential diagnosis, but is not thought to be highly probable.

In larger institutions, such patients are brought to the attention of a senior clinician or panel of clinicians who, by prior arrangement, have the task of making an initial assessment of suspected cases of VHF (see 3.3). In smaller institutions it may be necessary to seek outside opinion.

If this type of patient is informally brought to the attention of the Regional Director of National Health and Population Development, he/she merely takes note of it and awaits clarification from further clinical and laboratory investigations.
9.1.2.2 **A probable case of VHF (or suspect)** In this type of patient there are strong grounds for suspecting VHF and the head of the medical institution concerned, usually the Medical Superintendent of a hospital, provisionally notifies the Regional Director of National Health and Population Development of the case (see 9.1.3).

In turn, the Regional Director ensures that the existence of a probable case of VHF is made known to the Superintendent of the regional secondary hospital (if the secondary hospital is not already involved), the local Medical Officer of Health or equivalent official, the Special Pathogens Unit at the National Institute for Virology and the Director, Medical Services at the headquarters of the Department of National Health and Population Development.

The patient is placed in isolation and subjected to barrier-nursing pending clarification of the diagnosis. The clinicians concerned should make an early assessment of the case as being one involving either low, medium or high risk as set out in section 3.4.2, and on this basis a decision should be made in consultation with the Regional Director whether or not to transfer the patient to a secondary hospital, if this has not already occurred (see 6.5).

At this stage, registers should be prepared of all known contacts of the case inside the hospital/s involved as well as in the community at large, including relatives of the patient (see 9.2).

9.1.2.3 **A case of VHF** In such patients a specific diagnosis of VHF has been confirmed in the laboratory or has been made on the basis of very strong clinical and circumstantial evidence.

Confirmed cases of VHF are generally transferred to designated secondary hospitals unless there are strong contra-indications (see 6.1, 6.2 and 6.5).

Once a diagnosis of VHF has been confirmed, steps additional to those enumerated in 9.1.2.2 include convening a VHF Outbreak Management Committee and instituting a full programme of monitoring of the outbreak as outlined in section 8.5, including tracing and observation of all contacts of the case as outlined in section 9.2.

9.1.3 Notification of a possible, probable or confirmed case of VHF to the Regional Director should be done according to a checklist to ensure that none of the required information is omitted. For an example of a suitable form for this purpose see p.17.
9.2 Tracing and classification of contacts

9.2.1 Aim

The purpose of tracing all VHF contacts and placing them under observation is to control spread of infection and thus to terminate the outbreak.

9.2.2 Responsibility

The Regional Director of National Health and Population Development and his staff are ultimately responsible for tracing and observation of contacts.

In practice, the task is most conveniently performed by two separate teams which both report daily to the VHF Outbreak Management Committee:

9.2.2.1 One team operates within the hospital where the VHF patient is being treated and comprises hospital staff: usually the medical officer and senior nursing staff members who are ordinarily concerned with infection control in the hospital concerned, plus representatives of the VHF clinical team and laboratory. The team places all medical staff who have had contact with the patient or fomites under observation irrespective of whether such contact took place before or after barrier-nursing was instituted.

9.2.2.2 The other team, which operates within the community at large, comprises members of staff of the Regional Director of National Health and Population Development plus health officials of the Local Authority. Their first task is to trace the movements of the VHF patient for up to 3 weeks prior to onset of illness with a view to establishing the source of infection and preparing a list of all contacts who are at risk of developing the disease. The movements of the VHF patient should be traced for 3 weeks prior to onset of illness in the instances of Marburg, Ebola, Lassa fever and haemorrhagic fever with renal syndrome, whereas 2 weeks are appropriate for Crimean-Congo haemorrhagic fever (see 9.3.1).

9.2.3 Definitions

9.2.3.1 An index patient in an outbreak of VHF is the first patient in whom the diagnosis is made, not necessarily the first person to have acquired infection. Recognition of the disease in the index patient may lead to the uncovering of other infections in the same outbreak.
9.2.3.2 A source patient is a patient from whom transmission has occurred to produce secondary infection/s. The index patient and source patient may or may not be the same individual.

9.2.3.3 A contact is a person who has been exposed to an infected person, animal or contaminated environment in such a manner as to have had the opportunity to acquire infection.

9.2.3.4 A case contact is a person who has been exposed to an infected person or his/her secretions, excretions, blood or other tissues in such a way as to be at risk of acquiring infection.

9.2.3.5 A source contact is a person who has been exposed to the same source/s of infection as an infected person.

9.2.3.6 Exposure to infection which constitutes contact for purposes of VHF control, includes association with an infected person at any time from onset of fever until 3 weeks later in any of the following ways:-

sharing the same residence

face-to face contact (1 metre)

skin or mucous membrane contact or penetrating injury with the patient's secretions, excretions, blood or other tissues. This would include similar exposure to animal tissues in situations where such exposure is considered to be the source of infection.

9.2.3.7 It is useful to distinguish between low, moderate and high risk contacts:-

**Low risk contacts** have had slight or indirect contact with a VHF patient or other source of infection on a single or few occasions.

**Moderate risk contacts** have had close and prolonged contact with a VHF patient or other source of infection. This category includes intimate friends of a VHF patient, relatives and medical personnel.

**High risk contacts** have had what is judged to be definite exposure to VHF infection, e.g. needle-prick with blood from a confirmed case of VHF or similar exposure to animal tissues in a common-source outbreak.
9.3 **Observation**

9.3.1 **Observation of contacts** consists of recording temperatures of contacts twice daily for three weeks from the last date of contact with a VHF patient or fomite, and monitoring for any illness.

It is desirable to use a standard questionnaire for observation of contacts (see example p.19).

A three week observation period is appropriate for Marburg, Ebola, Lassa fever and haemorrhagic fever with renal syndrome, but Crimean-Congo haemorrhagic fever has a shorter incubation period and two weeks of observation is probably sufficient. Rift Valley fever also has a short incubation period, but since this virus seldom causes serious or haemorrhagic disease and since person-to-person spread has not been recorded, formal observation is not essential.

9.3.2 Observation may be active or passive:-

9.3.2.1 **Active observation** involves contacts being seen twice daily by medical officials charged with this responsibility.

9.3.2.2 **Passive observation** entails the contact reporting (e.g. by telephone) on their own condition to the observation officer.

Note: **observation** is used in preference to **surveillance** in this document since the terms active surveillance and passive surveillance are used in a different sense to denote monitoring of a population for the occurrence of a disease either **actively** through sampling a sub-population or **passively** through simply testing samples submitted voluntarily to the laboratory.

9.3.3 Passive observation is sometimes applied to contacts deemed to be reliable, e.g. medical personnel, but it is highly questionable whether this should be permitted where VHF is involved.

9.3.4 **Low to moderate risk contacts** of VHF (see 9.2.3.7) may be kept under observation in their normal environment, but should not leave the town/district.

All contacts must be seen twice daily (or heard from if passive observation is applied) and any unexplained absences from home or work must be investigated.
9.3.5 **High risk contacts** of VHF (see 9.2.3.7) must be kept under active observation or placed under quarantine in a suitable facility for the duration of the quarantine period.

It is not universally agreed that there is a need to confine high risk contacts to a quarantine facility, provided they are kept under active observation. At most, confinement to a quarantine facility should be applied very selectively to those considered to be in imminent danger of developing infection, e.g. medical staff who have had a finger-prick with blood known to be infected, or those who have developed non-specific illness, e.g. headache.

Quarantine facilities need not necessarily be in the same complex as VHF barrier-nursing units. Old infectious disease hospitals in isolated localities are ideal. Since confinement of essentially healthy people is involved, it is advantageous to have access to an outdoor area.

9.3.6 Any contact who develops fever (temperature of 38°C or over) or signs and symptoms suggestive of VHF, must be placed in isolation and treated as a suspected case.
CHECKLIST/FORM FOR NOTIFICATION OF A CASE OF VIRAL HAEMORRHAGIC FEVER

Informal notification of a possible case of VHF

Provisional notification of a probable case of VHF

Formal notification of a confirmed case of VHF

Patient Name: .................................................... Age:....... Sex:....... Occupation: .........................

Home address: ................................................... Work Address: ...................................................

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Home tel:  .................................................... Work tel: ....................................................

Hosp. no: ............................ Hospital: ........................................ Date of Admission: ..................

Notifying doctor: Doctor in charge of patient:

Name: .......................................... Name: .............................................

Position: ....................................... Position: .....................................

Institution: .................................... Institution: ...................................

Work tel:  ............................... Work tel: ......................................

Home tel:  ............................... Home tel: ...................................

Brief history: ..........................................................................................................................

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DATE OF ONSET OF ILLNESS: .................................................................................................

Treatment: ............................................................................................................................

Progression: ..........................................................................................................................

Differential diagnoses: ............................................................................................................

Provisional diagnosis: .............................................................................................................

Confirmed diagnosis: .............................................................................................................

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During the past 3 weeks has the patient had contact with:

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# VIRAL HAEMORRHAGIC FEVER (VHF)
## QUESTIONNAIRE FOR OBSERVATION OF CONTACTS

Name.................................... Age..... Sex..... Occupation....................................

Home address...................................... Work address.............................................

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Home tel: ........................................ Work tel: ........................................

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Interviewed by  .......................... Date  ............. Place  ..........................
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10. NOTES ON SAFETY EQUIPMENT

These brief notes are intended merely to provide an indication of some of the types of safety equipment which are available. The fact that many of the items are manufactured by Vickers Ltd Medical Engineering, does not reflect particular endorsement of these items, but simply reflects the fact that these items are in use in South Africa.

10.1 Protection of individual staff members

The degree of protection required varies with the condition of the patient (see 3.4.2).

10.1.1 Full-face respirators with visor/goggles and high efficiency particulate air (Hepa) filter (=gas masks). Available from various manufacturers. Uncomfortable and tiring to use.

10.1.2 Clear acrylic full-face visors (as used in autopsy rooms). Similar to welders’ visors. Comfortable, but should be worn with disposable surgical face mask and balaclava.

10.1.3 Positive-pressure ventilated respirators with Hepa filter, fan motor and rechargeable battery on adjustable harness (= Vickers Medical High Efficiency Respirators). Somewhat uncomfortable, but for the inexperienced, using these is a far less clumsy way of dealing with patients than using a bed isolator. Easy to move to the scene of outbreaks and probably represents the most practical system for barrier-nursing. Easy to learn to use. At present 6 are available for loan from Rietfontein Hospital, Johannesburg (see directory), but it is recommended that at least 4 per regional secondary hospital are acquired and these made available to ambulance crews and primary hospitals as may be necessary.

10.2 Patient isolators: bed and transport

10.2.1 Vickers containment bed isolators

The patient's bed is enclosed in a flexible film tent with air supplied at negative pressure and exhausted through a Hepa filter. Access to the patient is through half-suits for staff, built into the wall of the isolator. Bed isolators require a large floor area, are expensive and tedious to use. Staff need training and practice. However, once staff are accustomed to bed isolators, the use of the isolators is found to be less irksome than constantly changing into protective clothing and respirators. The isolators are not readily transportable and are unsuitable for delirious and aggressive patients. They have a depressing effect on convalescent patients. Isolators can only cope with one patient at a time, whereas respirators can be used by staff treating several patients.
10.2.2 **Vickers aircraft transit isolators**
Similar in principle to the bed isolators but smaller and with battery-driven air supply. Access to the patient is through built-in glove ports. They are too large for small aircraft and helicopters, therefore it is very difficult and expensive to arrange air transport. They are too large for most enclosed road vehicles and require large trucks. They are too large to fit through single doors in buildings. May be desirable for very long journeys, but possibly not required for journeys within southern Africa. An aircraft isolator can be made available from Rietfontein Hospital, Johannesburg (see directory) for long journeys.

10.2.3 **Vickers stretcher transit isolators (= ambulance isolators)**
Similar to the aircraft isolators but smaller and will fit in relatively small aircraft and helicopters. Will fit in large ambulances. These would probably suffice for patient movement within southern Africa.

At present there is one at Rietfontein Hospital, Johannesburg, and one at the Metro Control of the Emergency Services Centre in Cape Town (see directory). Possibly one each should be acquired for Natal, the Orange Free State and the eastern Cape.

10.3 **Laboratory isolators**

10.3.1 **Vickers Pathoflex patient management isolators**
These can be purchased fully equipped for haematological, biochemical and bacteriological monitoring of patients. The concept of having such an equipped isolator on standby in South Africa for removal to the site of haemorrhagic fever outbreaks, is not considered a workable proposition. There would be problems with: conflicting demands for the isolator, logistics, sterilization of the isolator and contents in between uses and difficulty in adequately disseminating knowledge of the assembly, collapse (for transport) and proper use of the isolator. It is considered much better to utilise small units within existing laboratories at regional centres which are specifically designated for dealing with VHF (see 7.3). Isolators could be acquired and used in such units as an alternative to biohazard laminar flow cabinets.

10.3.2 **Vickers Pathoflex FC benchtop isolator**
A very small flexible film isolator essentially designed for microscopy, but could be used for limited laboratory monitoring of patients. May be useful virtually "at the bedside" in specially equipped barrier-nursing units.
SAFETY EQUIPMENT

VIC KERS PATHOFLEX PATIENT MANAGEMENT ISOLATOR

VICKERS PATHOFLEX F C BENCHTOP ISOLATOR

(AMBULANCE) STRETCHER ISOLATOR

VICKERS MEDICAL HIGH EFFICIENCY RESPIRATOR

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11.1 LASSA FEVER

Distribution and occurrence

The disease was first recognized in missionary nurses in Nigeria in 1969 and cases are seen each year in several countries in west Africa. Residents and visitors to west Africa who travel by air occasionally develop the disease abroad and hence cases have been seen in Europe, America and Japan.

It is becoming clear that there is a cluster of related viruses in Africa. Mopeia, a virus closely related to Lassa but not known to be pathogenic for man, has been isolated from multimammate mice in Mozambique, Zimbabwe and South Africa. There have been no recognized cases of Lassa-like disease in southern Africa, but antibodies have been found in serosurveys.

Source, transmission and epidemiology

The reservoir host is the multimammate mouse which occurs widely in Africa. The rodents develop chronic infection with prolonged excretion of virus in saliva and urine. Transmission to man is believed to occur through contamination of food and dust with urine. Virus is present in the body fluids of patients and person-to-person spread occurs in the home and hospital. Although aerosol transmission is suspected to occur with rodent excretions, person-to-person spread seems to require overt contact with infected tissues and body fluids. Antibody studies indicate that case-to-infection ratios may be as low as 1:30 in rural situations with rodent-to-human transmission, but the severity of illness is greater in nosocomial transmission. Case-fatality rates range from about 14% in endemic disease to 52% in nosocomial outbreaks.

Clinical signs and symptoms

The incubation period of Lassa fever is usually 7 to 10 days, but ranges from 3 to 21 days. Viraemia lasts about a week, but prolonged excretion of virus in urine has been described.

The onset is insidious with fever, chills, malaise, headache and generalised pains. It is said to be characteristic of the more severe cases that prostration is out of proportion to fever. Within two or three days the patients develop sore throat, vomiting and abdominal or chest pains, low blood pressure and bradycardia. There is characteristic inflammation of pharyngeal and tonsillar tissues with whitish or yellowish exudate and small vesicular and ulcerative lesions. Conjunctivae are injected and there is lymph-adenopathy, muscle tenderness, pulmonary rales and occasionally maculopapular rash. From day 5 onwards some patients progress to a severe continued fever and toxemia with hemorrhages, puffiness of the face and neck, serous effusions, disorders of the central nervous system and a state of shock.

Observations on clinical pathological findings have been limited. Transient leukopaenia may be followed by leukocytosis. Early leukocytosis has been described in some patients. Proteinuria occurs. Abnormalities in platelet counts, prothrombin and clotting time are not marked. Pronounced increases in liver enzymes, lactic dehydrogenase and creating phosphokinase have
been described.
11.2 ARGENTINIAN AND BOLIVIAN HAEMORRHAGIC FEVERS

There is a group of rodent associated arenaviruses in South America similar to the Lassa group in Africa, but antigenically unrelated to the African viruses. Two of these viruses are associated with serious disease: Junin virus causes Argentinian haemorrhagic fever and Machupo virus causes Bolivian haemorrhagic fever. The occurrence of these diseases in Africa would be a rare event, but is not impossible in view of the tourist trade between South Africa and South America.
11.3 MARBURG VIRUS DISEASE

**Distribution and occurrence**

Only confirmed outbreaks of this disease have been recorded.

It was first recognized in 1967 when 31 persons became ill in Europe following the importation of vervet monkeys from Uganda. Twentyfive of the cases occurred in people who had contact with infected monkeys or monkey tissues and six secondary cases occurred in people who had contact with the initial patients.

In 1975 the disease occurred in a hitch-hiker in South Africa who appears to have acquired infection in Zimbabwe. His girlfriend was a secondary case and tertiary infection occurred in a nurse.

An outbreak in Kenya in 1980 involved a primary case and secondary infection in a physician.

**Source, transmission and epidemiology**

No natural reservoir has been identified. Little evidence of infection has been found in monkeys in Africa and they appear to be as susceptible as humans, so the name "green monkey disease" is in-appropriate. Transmission occurs readily from contact with patients or infected tissues. Airborne infection has not been recorded. One case in the original outbreak is thought to have resulted from sexual transmission. Natural case-to-infection ratio is unknown but the case-fatality rate in the recorded outbreaks is 26%.

**Clinical signs and symptoms**

The incubation period is 3 to 9 days and there is sudden onset with fever, headache, myalgia, sore throat, anorexia, nausea, malaise and prostration. Viraemia lasts about a week, but excretion of virus in semen was recorded 12 weeks after onset of illness in one instance. Virus has been recovered from liver biopsy and from fluid from the anterior chamber of the eye (with uveitis) two months after onset of illness.
Watery diarrhoea and vomiting are common. A maculopapular rash starts on the face and trunk on the fifth to seventh day of illness and spreads to the extremities. Discrete maculae merge to form a dark erythema, followed by desquamation 3 to 4 days later. Conjunctivitis and enanthema of the hard and soft palates is common. Mental confusion, depression, somnolence as well as restlessness and hyperaesthesia can occur. There may be remission of fever on about day 6 followed by a second peak of fever a few days later.

There is marked leukopaenia in early infection followed by extreme thrombocytopenia between days 6 to 12, often associated with disseminated intravascular coagulopathy (DIC) and haemorrhagic diathesis with epistaxis, haematemesis, haematuria, melaena and bleeding from gums and needle puncture sites. Coagulation factors are reduced and liver enzymes markedly raised. Leukocytosis occurs in the latter stages of illness and convalescence is prolonged.

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11.4 EBOLA VIRUS DISEASE

Distribution and occurrence

The disease was first seen in simultaneous outbreaks involving hundreds of cases in Zaire and Sudan in 1976 and since then small outbreaks have been described in both countries and in Kenya. Antibodies which react with Ebola virus antigen have been found in surveys of hospital staffs and general populations elsewhere in Africa, including South Africa, without a specific association with disease. This could indicate either that there are non-specific, heterologous reactions to Ebola antigen, or that there are non-pathogenic strains of the virus. The occurrence of such reactions complicates the task of establishing a laboratory diagnosis. Zaire and Sudan strains of Ebola virus are ordinarily cross-reactive in serological tests, but are not cross-protective in laboratory animals.

Source, transmission and epidemiology

The primary source of infection is unknown, but there is person-to-person spread and nosocomial infection occurs with facility, particularly through contact with blood. Experience in Zaire and Sudan suggested that airborne transmission was not involved. Contaminated hypodermic needles were a major factor in spread of the virus. Case-to-infection ratios are unknown but are probably higher in nosocomial transmissions than in other situations. Case-fatality rates ranged from 53% in Sudan to 88% in Zaire.

Clinical signs and symptoms

Both the incubation period (range 2 to 17 days) and the duration of clinical disease average about one week, but convalescence is prolonged. Viraemia has been demonstrated up to the eighth day of illness, but may last a few days longer than this.

There is sudden onset and symptoms experienced by most patients include fever, severe headache (often frontal to begin with), sore throat, chest and/or abdominal pain, myalgia, arthritis, malaise, fatigue, nausea and anorexia.
Signs exhibited by patients include oral/throat lesions, persistent diarrhoea and vomiting, dehydration, dry cough, conjunctivitis and non-itching maculopapular rash of trunk and limbs with onset on about day 5 of illness and desquamation a week to 10 days later. The rash may be difficult to discern in dark-skinned patients, but the desquamation is more apparent and may involve palms and soles. There may be splenomegaly and non-icteric hepatitis with epigastric tenderness. Pregnant women may abort.
Clinical laboratory tests have been very limited. There may be transient leukopaenia followed by leukocytosis, reduced platelet counts, raised liver enzymes, proteinuria and low haemoglobin values.

The more severe and fatal cases progress to a haemorrhagic state by about day 5 to 8 of illness with bleeding from needle puncture or scarified sites, mouth/gingival bleeding, haematemesis, melaena and epistaxis. Central nervous system symptoms include aggressive and altered behaviour. Dehydration is severe.

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11.5 RIFT VALLEY FEVER

Distribution and occurrence

Rift Valley fever (RVF) occurs widely in Africa and is an important disease of livestock. It was first recognized in South Africa in 1951 in a major epizootic in the Orange Free State and southern Transvaal. Epizootics have occurred at irregular intervals of years since then and have involved increasing areas of the country, including all provinces.

Source, transmission and epidemiology

RVF is transmitted by mosquitoes and it was originally thought that the virus was maintained in coastal forests where it cycled in mosquitoes and an unknown vertebrate reservoir host. Epizootic spread to livestock areas was thought to occur by extension from these enzootic forest areas. It now appears that RVF is widely enzootic in the interior and probably persists by transovarial transmission in flood-water breeding *Aedes* mosquitoes. Findings in Zimbabwe indicate that a low degree of virus activity occurs in livestock populations each year, but that major epizootics occur at intervals of many years when exceptionally heavy rains favour breeding of mosquitoes. The last major epizootic in South Africa occurred in 1974-75.

Mosquito vectors of RVF in southern Africa do not appear to be anthropophilic and man usually acquires infection from contact with sick animals or carcasses. Laboratory infections are not uncommon and aerosol infection has been described in the laboratory and under field conditions. Intense viraemia occurs in man and while person-to-person spread seems perfectly feasible, it has not been documented.

Deaths and abortions in sheep and cattle occur on a large scale during epizootics so that rural communities soon become aware of an epizootic. Cases are usually seen in farmers, their labourers, veterinary personnel and sometimes slughtermen. These patients are frequently aware of RVF and suggest the diagnosis themselves. Cases are usually seen in the latter part of the wet season from January to May, with a peak in March-April.

Accidental transmissions in laboratories have shown that mild to inapparent infections can occur, but no
satisfactory data exist for estimating case-to-infection ratios. Predisposing factors markedly influence outcome so it is not possible to produce a figure for case-fatality rate, but this probably does not exceed 1%. Fatal outcome is more common in older or very young people, in alcohol abuse or where there is other underlying liver disease. In the Egyptian outbreak in 1977 there were numerous deaths with necrotic hepatitis and it was thought that widespread schistosomiasis contributed to the fatalities.
Clinical signs and symptoms

The incubation period is about 2 to 6 days. Viraemia commonly lasts 2 to 3 days but has been recorded for up to 11 days. The disease can take 4 forms:

(i) Mild cases are recognized only when known accidental infection occurs as in laboratories. Patients may present with only transient headache, fever and chills.

(ii) Most cases present as moderate to severe influenza-like illness. There is sudden onset with severe retro-orbital pain and headache, photophobia, suffused conjunctivae, myalgia, arthralgia, prostration, nausea and tenderness of the liver without hepatomegaly. Fever and prostration often last only 2 to 3 days but the disease may run a biphasic course over two weeks. Ocular complications occur in a small proportion of cases 1 to 3 weeks after onset of illness. Decreased visual acuity or blurring is associated with retinal haemorrhages, exudate and macular oedema. Vision usually improves over a period of months as lesions resolve, but occasionally there can be detached retina and blindness.

(iii) Encephalitis can occur as a complication one to two weeks after the common febrile form of the disease. Recovery may be sudden or protracted, or there may be fatal outcome.

(iv) Haemorrhagic fever with or without neurologic disease, can supervene within a week after the acute febrile period. Extensive liver necrosis is a major factor contributing to the usual fatal outcome in these cases and there may be marked anaemia following massive epistaxis, haematemesis and melaena. Petechiae, ecchymoses and jaundice may be evident. There is usually leukopaenia, hyperbilirubinaemia, thrombocytopenia, prolongation of clotting parameters and markedly raised liver enzymes.
11.6 CRIMEAN-CONGO HAEMORRHAGIC FEVER

Distribution and occurrence

Crimean-Congo haemorrhagic fever (CCF) occurs in eastern Europe, Asia and Africa. This distribution corresponds to that of the main vectors of the virus: ticks of the genus *Hyalomma*. The ticks are known as bontpoot or bontleg ticks in South Africa. Other tick species appear to transmit CCHF virus less frequently.

Results obtained in a survey on cattle sera indicate that antibodies to CCHF virus occur widely in South Africa. There are regional differences in prevalence of antibody which appear to relate to differences in the distribution of the three species of *Hyalomma* tick in South Africa. In practical terms, human cases of CCHF could be seen anywhere in the country, and this is particularly true of secondary cases arising from person-to-person spread. The evidence suggests that the virus has occurred widely in southern Africa for many years and there is no reason to suppose that it is spreading. Increased awareness and the availability of laboratory tests have probably resulted in increased recognition of cases. Ten to 20 cases of the disease are diagnosed each year in South Africa, mainly in the western Transvaal, western Orange Free State and north-west Cape provinces, arid areas well suited to *Hyalomma* ticks.

Source, transmission and epidemiology

CCHF virus passes through the eggs of infected female *Hyalomma* ticks to infect the progeny ticks in a proportion of instances. Ticks also gain infection when the immature stadia feed on viraemic small mammals such as hares. Adult *Hyalomma* ticks feed on and transmit infection to livestock. There is no evidence that cattle and sheep become ill from CCHF infection, but during infection they are briefly viraemic and can act as a source of infection for man. The danger is increased if animals are slaughtered or die from other causes during CCHF infection and are butchered or autopsied.

Man gains infection from tick-bite, from squashing ticks, or from contact with fresh blood or blood-tinged secretions, excretions and other tissues of livestock, wild vertebrates or human patients. Nosocomial infection is not uncommon and appears to involve direct contact with infective blood.
There has been no evidence of aerosol transmission.

Case-to-infection ratios are not well established since laboratory diagnostic techniques were inadequate in early Eurasian studies, but mild and inapparent infections appear to be rare in South Africa. Case-fatality rates range from 15% to 70% (28% in South Africa) and are often high in nosocomial outbreaks.
Clinical signs and symptoms

The incubation period is short, invariably less than a week and there is very sudden onset with severe headache, fever and chills. Viraemia lasts up to 12 days. Nervous signs are frequently prominent and include dizziness, amnesia, confusion or changed behaviour. There is generalized influenza-like illness and prostration with myalgia, lumbar and epigastric pains, anorexia, liquid stools, nausea and repeated vomiting unrelated to eating.

Frequently the patient has hyperaemia of the face, neck and chest, conjunctivitis, congested sclerae, slight pharyngitis with spotted enanthema, bradycardia and low blood pressure.

Severe cases enter a haemorrhagic state on day 3 to 6. Haemorrhages vary from petechial rash to large ecchymoses and haematomas on mucous membranes and the skin, especially on the upper body, along posterior axillary lines, in antecubital fossae, under breasts of women and at pressure and injection sites. There may be epistaxis, mouth/gingival bleeding, haematemesis and melaena. Pregnant woman may abort.

By the time that patients seek medical attention, there is usually leukopaenia, thrombocytopenia and raised aspartate and alanine aminotransferase (AST and ALT) levels. Occasionally there is leukocytosis instead of leukopenia.
11.7 **HAEMORRHAGIC FEVER WITH RENAL SYNDROME (HFRS)**

**Distribution and occurrence**

HFRS is the recommended term for a group of diseases which occur from the Far East across to Western Europe. They are caused by related viruses which are associated with rodents. Similar viruses have been isolated from rodents in North America and it is surmised that the viruses may have become distributed worldwide with ship-borne rodents. The prototype virus for the group, Hantaan virus (the causative agent of Korean haemorrhagic fever), was only isolated comparatively recently and a proper understanding of the disease-relationships of new members of the group is still evolving, although some clinical entities have been known for decades.

The diseases vary in severity from a haemorrhagic fever with renal syndrome in the Far East to a generally mild nephropathy in Europe, although deaths are on record in Europe. Regional terms for the diseases are:-

- **Japan**: Epidemic haemorrhagic fever (EHF)
- **Korea**: Korean haemorrhagic fever (KHF)
- **China**: Songo fever or EHF
- **Soviet Union**: Haemorrhagic nephroso-nephritis or HFRS
- **Eastern Europe**: Epidemic nephritis or EHF
- **Scandanavia**: Nephropathia epidemica (NE)

Antibodies have been found in South Africa in rats from harbours and in desert gerbils. Attempts to isolate virus from rodents are in progress. Antibodies have been found in human serosurveys but no association has been made with disease.

**Source, transmission and epidemiology**

The viruses cause chronic infection in rodent reservoir hosts and are excreted in high concentration in rodent saliva, urine and faeces over a period of months. It has been postulated that mites may play a role in transmitting infection between rodents, but virus spreads rapidly and efficiently by aerosol in the absence of ectoparasites.
Three epidemiological situations are recognized in human disease:-

**Rural**: occupational and recreational exposure to the outdoors is involved. Seen in farmers, soldiers, hunters, fishermen, lumberjacks and railroad workers in Europe and Asia. Associated with feral rodents (voles). Disease is commonest in spring and autumn and this probably reflects increased exposure at peak times of farming activity.

**Urban**: involves domestic rats as reservoir hosts. Seen in cities in Korea (where rural form also occurs) and in Japan. Disease most common in autumn and winter, possibly when rodents are driven into closer association with man and the air is dry.

**Laboratory**: associated with colonized rats in laboratories. Described in Korea, Japan, France, Belgium and England.

In the most virulent Far Eastern forms of the disease, 30 to 40% of cases run a mild course, 50 to 60% are moderate and 20 to 30% are severe. Case-fatality rate is 5% in treated patients.

**Clinical signs and symptoms**

The incubation period is generally 2 to 3 weeks.

The relatively mild form of the disease, as is commonly seen in Europe, is characterised by sudden onset of fever and signs of renal failure. Full recovery is usual.

Severe infection with virulent Far Eastern virus produces disease in which five phases are often recognizable:-

**Febrile phase**: has sudden onset and lasts 3 to 7 days. Marked by high fever, chills, malaise, myalgia, anorexia, dizziness, headache and ocular pain. Abdominal and back pain with tenderness in the renal area occur as a result of peritoneal and retroperitoneal oedema.

This is followed by characteristic flushing of the face, neck and anterior chest with injection of the eyes,
palate and pharynx. Towards the end of the phase there are fine petechial in axillary folds, on face, neck, soft palate and anterior chest, together with conjunctival haemorrhage.

Proteinuria occurs during this phase and reaches high levels.

**Hypotensive phase:** starts abruptly and lasts hours to 2 days. Marked by classical shock: tachycardia, narrowed blood pressure, hypotension, cold and clammy skin, dulled senses and confusion. One-third of fatal cases enter irreversible shock at this stage.

There is marked proteinuria, mild haematuria, raised haematocrit level, leukemoid reaction and thrombocytopaenia. Capillary haemorrhages are prominent.

**Oliguric phase:** lasts 3 to 7 days. Oliguria starts and blood urea and creatinine increase. Blood pressure begins to normalize but hypertension may result from hypervolaemic state. Severe nausea and vomiting may occur. Bleeding tendencies increase markedly: epistaxis, conjunctival haemorrhage, cerebral and gastrointestinal haemorrhage and extensive purpura occur.

Hyperkalaemia, hyponatraemia and hypocalcaemia occur. Central nervous system symptoms and pulmonary oedema occur and 50% of fatalities take place in this phase.

**Diuretic phase:** may last for days or weeks. Marks the start of clinical recovery. Diuresis of 3 to 6 litres per day is common, but this can be influenced by dehydration, electrolyte imbalance, secondary infection and the severity of the disease.

**Convalescent phase:** may last 2 to 3 months. There is progressive recovery of glomerular filtration rate, renal blood flow and urine-concentrating ability.
11.8 YELLOW FEVER

Yellow fever, which occurs in west Africa and South America, frequently presents as classical haemorrhagic fever. Blood and tissues are infected, but yellow fever is not readily transmitted from person-to-person. Nevertheless, it can cause explosive mosquito-borne epidemics and it is regarded as a serious notifiable disease. Wild primates can act as reservoir hosts but urban yellow fever requires only the presence of man and mosquitoes. Suitable mosquito vectors and susceptible populations of humans exist in many parts of the world which are currently free of yellow fever. Owing to the existence of an extremely effective vaccine, and regulations requiring immunisation of international travellers, the occurrence of a case of yellow fever in southern Africa is very unlikely. The nearest outbreak was in Luanda, Angola, in the early seventies.

11.9 DENGUE

Dengue, or breakbone fever, can present as haemorrhagic fever in certain circumstances. The virus is endemic in South America, the Caribbean, India and south-east Asia. There are four serotypes and infection is usually associated with moderate to severe influenza-like illness with rash and marked arthralgia. The haemorrhagic form of the disease occasionally occurs in the very young or involves an auto-immune mechanism in a recovered person who becomes exposed to a second serotype of the virus. As with yellow fever, only susceptible humans and mosquitoes are required for maintenance of the virus and hence human travellers may be responsible for carrying the virus over vast distances to set up new centres of infection. The last known outbreak of dengue in South Africa occurred in the Durban area in the twenties and was associated with ship-borne infection. Dengue has reached east and west Africa recently and is said to be smouldering in those areas, so there is need for vigilance.

11.10 CHIKUNGUNYA

Chikungunya is a mosquito-borne virus of Africa and Asia which causes febrile illness associated with a maculopapular-rash and protracted arthralgia involving one or more joints. A haemorrhagic form of the disease, described in Asia, has not been recorded in Africa. There may have been confusion with dengue haemorrhagic fever on occasion. Wild primates serve as reservoir hosts for the virus and in South Africa infection occurs in northern Natal and eastern and northern Transvaal where there are large populations of monkeys and baboons.
OMSK HAEMORRHAGIC FEVER AND KYASANUR FOREST DISEASE

Omsk haemorrhagic fever is a tick-borne virus of Siberia and Kyasanur forest disease is a tick-borne virus of the Indian subcontinent. These infections are unlikely to be seen in Africa.

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