Guidelines for Prevention and Control of

Leptospirosis

Joint Publication by:

ZOONOSIS DIVISION
National Institute of Communicable Diseases
(Directorate General of Health Services)
22-Sham Nath Marg, Delhi - 110 054

World Health Organization
Country Office for India

Guidelines for Prevention and Control of Leptospirosis

ZOONOSIS DIVISION
NATIONAL INSTITUTE OF COMMUNICABLE DISEASES
(Directorate General of Health Services)
22-SHAM NATH MARG, DELHI - 110 054

Copyright © Word Health Organization (2006)

This document is not a formal publication of the World Health Organization (WHO), and all rights are reserved by the Organization. The document may, however, be freely reviewed, abstracted, reproduced or translated, in part or in whole, but not for sale or for use in conjunction with commercial purposes.

The views expressed in documents by named authors are solely the responsibility of those authors.

CONTENTS

GUIDELINES FOR PREVENTION AND CONTROL OF LEPTOSPIROSIS

1. Introduction

India with an 8,129 km long coastline and with endowment of plenty of natural resources has one of the major important coastal, agro-ecosystem that supports livelihood of several million people and contributes substantially to the national economy. However, this agro-ecosystem is highly fragile. Due to the rapid ecological changes in the region during the past decade many new zoonotic diseases have emerged and resulted in epidemics leading to significant morbidity and mortality in humans. Leptospirosis is one among them. The change in the distribution and incidence rate of leptospirosis has occurred proportionately to the alterations in the eco-system. Reclamation of wastelands, aforestations, irrigation changes in crops and agricultural technology have been important factors. The areas which would have remained free of this infection have converted into potentially endemic zones either by the changes brought out by man or the nature. The outbreaks of leptospirosis have been reported from coastal districts of Gujarat, Maharashtra, Kerala, Tamil Nadu, Andhra Pradesh, Karnataka and Andamans from time to time. In addition, the cases have been reported from Goa and Orissa.

2. Bacteriology

Leptospirosis is primarily a contagious disease of animals, occasionally infect humans and is caused by pathogenic spirochete of the genus leptospira that traditionally consist of two species *L.interrogans* and *L.biflexa*. The former includes all pathogenic serovars and the later includes the saprophytic strains. Leptospira strains have been divided into 23 sub groups of which 2 belong to saprophytic leptospires. Each sub-group consists of several strains designated as serovars. More than 260 host adopted leptospiral serovars are naturally carried by more than a dozen species of rodents, wild and domestic animals in moderate to highly conducive abundantly available variety of hosts, resulting in very successful perpetuation of this organism. The leptospira serovars predominantly present in

India are *L.andamana, L.pomana, L.grippotyphosa, L.hebdomadis, L.semoranga, L.javanica, L.autumnalis, L.canicola*.

3. Factors responsible for emergence of Leptospirosis

The conditions that are favorable for maintenance and the transmission of the leptospirosis are as follows –

3.1 Reservoir and carrier hosts

Leptospirosis has a very wide range of natural rodent and non-rodent reservoir hosts which include foxes, rabbits etc. The domestic animals carry the microorganisms and therefore act as carriers of the leptospires. Together the rodents and the cattle excrete large number of organisms in their urine and thus are responsible for the contamination of soil as well large and small water bodies.

3.2 Drainage congestion and water logging

Heavy concentrated rainfall leaves a lot of surplus water. Developmental activities like canal network, roads and railway lines obstruct natural drainage of rain water causing its accumulation for longer periods. The water logged areas force the rodent population to abandon their burrows and contaminate the stagnant water by their urine. The farmers and agricultural labourers working in the water logged contaminated fields catch the infection.

3.3 Soil salinization

In fact, salinity and water logging are inter-linked problems. The salinity of the soil provides favorable environment for survival of leptospires for months together.

3.4 Soil temperature

The soil of endemic areas in general has lower base saturation and the mean annual soil temperature at the depth of 50 cm is 22^0C or more and the difference between mean summer (June-August) and mean winter (December-February) temperature is less than 5^0C. This favors the survival of leptospires for long durations.

4. Mode of transmission

Infection is acquired through contact with the environment contaminated with urine of rodents, carrier or diseased animals. Direct transmission of leptospirosis is rare.

5. Age and sex distribution

Males suffer more frequently from leptospirosis than females because of greater occupational exposure to infected animals and contaminated environment. Gender difference in susceptibility is not apparent under conditions where both men and women are at equal risk. Leptospiral infections occur more frequently in persons 20-30 years of age group. Leptospirosis rarely occurs in young children and infants, possibly, because of minimal exposure.

6. Seasonal variation

Leptospirosis is usually a seasonal disease that starts at the onset of the rainy season and declines as the rains recede. Sporadic cases may occur throughout the year.

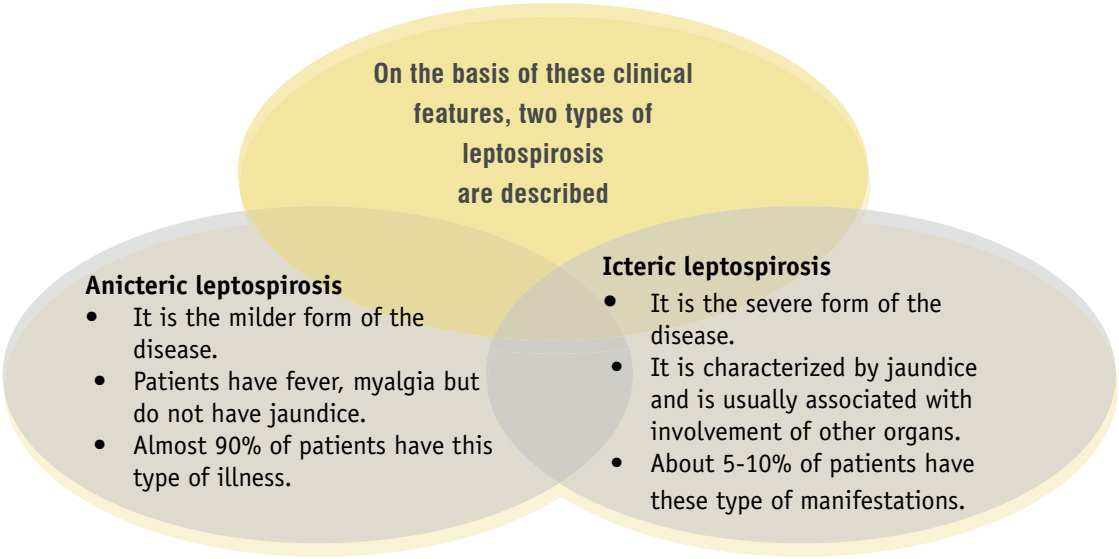
7. High risk groups

Agricultural workers such as rice field planters, sugar cane and pineapple field harvestors, livestock handlers, labourers engaged in canal cleaning operations are subjected to exposure with leptospires which have reservoir in rodents, cattle, swine, sheep, goats etc.

Some occupational groups are –

Fishermen, sewer workers and all those persons who are liable to work in rodent infested environment.

Lorry drivers and masons - As lorry drivers may use contaminated water to wash their vehicles and masons may come in contact with the organisms while preparing the cement and sand mixture for construction work with contaminated water.



8. Spectrum of illness

8.1 Clinical types:

The clinical spectrum of leptospirosis is very wide, with mild anicteric presentation at one end to severe leptospirosis with severe jaundice and multiple organ involvement on the other.

On the basis of these clinical features, two types of leptospirosis are described.

Anicteric leptospirosis

- It is the milder form of the disease.
- Patients have fever, myalgia but do not have jaundice.
- Almost 90% of patients have this type of illness.

Icteric leptospirosis

- It is the severe form of the disease.
- It is characterized by jaundice and is usually associated with involvement of other organs.
- About 5-10% of patients have these type of manifestations.

8.2 Anicteric Leptospirosis:

The patients present with :

- **Fever** - Patients have remittent fever with chills. It may be moderate to severe.
- **Myalgia**-It is a very characteristic finding in leptospirosis. Calf, abdominal & lumbosacral muscles are very painful & severely tender. This symptom is very useful in differentiating leptospirosis from other diseases causing fever. There is associated increase in serum Creatinine Phosphokinase (C.P.K.) which helps in differentiating leptospirosis from other illnesses.
- **Conjunctival Suffusion**- There is reddish colouration of conjunctiva. Very useful sign in leptospirosis. Usually bilateral, most marked on palpebral conjunctiva, it may be associated with unilateral or bilateral conjunctival haemorrhage.
- **Headache** - Usually intense, sometimes throbbing, commonly in frontal region. It is often not relieved by analgesics.
- **Renal manifestations -** Some form of renal involvement is invariable in leptospirosis. It usually occurs as asymptomatic urinary abnormality in the form of mild proteinuria with few casts & cells in the urine. Severe renal involvement in the form of acute renal failure, (which occurs in icteric leptospirosis) is rare.
- **Pulmonary manifestations -** Manifested in most cases through cough & chest pain and in few cases by haemoptysis. Severe involvement leading to respiratory failure does not occur in anicteric leptospirosis.
- **Hemorrhage**- Hemorrhagic tendencies are also present in some cases.

Note: All the clinical features either decrease or disappear within two to three days and then they reappear.

- **Differential diagnosis-**The patients of anicteric leptospirosis are likely to be misdiagnosed as malaria, dengue hemorrhagic fever, viral hepatitis etc.

Note: In endemic area all cases of fever with myalgia and conjunctival suffusion should be considered as suspected cases of leptospirosis.

8.3 Icteric Leptospirosis: -(Weil's syndrome)

This is the more severe form of leptospirosis. As the name suggests all patients have jaundice. Patients present with: -

- Fever
- Same as in anicteric leptospirosis but may be more severe.
- Myalgia
- Headache
- Conjuctival suffusion
- Oliguria/Anuria and/or proteinuria
- Nausea, vomiting
- Abdominal pain

Same as in anicteric leptospirosis but may be more severe.

In addition, they have features of organ involvement. An individual patient may have features of one or more organ involvement. The more severe form of disease with severe liver and kidney involvement is known as Weil's syndrome. Salient features of these organ involvements are described below.

8.3.1 Hepatic:

Jaundice is the most important clinical feature. It may be mild to severe. It starts after 4 to 7 days of illness. Hepatic encephalopathy or death due to hepatic failure is rare. Hepatomegaly & tenderness in right hypochondrium are usually detected.

Laboratory investigations show raised level of serum bilirubin (direct) and alkaline phosphatase. SGOT & SGPT are either normal or mildly elevated. This helps to differentiate leptospirosis from viral hepatitis where SGPT is markedly elevated and also from alcoholic hepatitis where SGOT is markedly elevated. High level of Creatinine Phosphokinase (CPK) is suggestive of Leptospirosis. It is normal in viral hepatitis and alcoholic hepatitis helps in differential diagnosis.

8.3.2 Renal:

Renal involvement is almost invariably present in leptospirosis. In severe cases patients have acute renal failure and present with:

- Decreased urine output (oliguria or even anuria)
- Oedema may be present on face and feet.
- Features of uremia like breathlessness, convulsion, delirium and altered level of consciousness may be present in very severe cases.

The renal dysfunction worsens during the first week to the end of 2nd week, after which it starts improving and complete recovery occurs by the end of the 4th week. There is usually no residual renal dysfunction.

8.3.3 Pulmonary involvement:

High mortality due to pulmonary involvement is becoming a feature in Leptospirosis.

There are wide variations in pulmonary presentation. It is the commonest cause of death due to leptospirosis.

Symptoms: In mild cases patient will show only cough, chest pain and blood tinged sputum. In severe cases patients have cough, haemoptysis, rapidly increasing breathlessness which may lead to respiratory failure and death.

On examination, these patients have increased respiratory rate with basal creptations, which rapidly spread upwards to middle and upper lobes.

X-ray shows basal and mid zone opacity in severe cases. It may be normal in mild cases.

The under lying pathology is intra-alveolar haemorrhage.

More than ninety percent (90%) of deaths due to leptospirosis occur due to pulmonary alveolar haemorrhage.

8.3.4 Cardiovascular system involvement:

Patients can have any one or more of the following features:

Haemorrhage

They occur because of 1) Thrombocytopenia, 2) Disseminated Intra-vascular Coagulation (DIC), 3) Secondary to liver involvement leading to coagulation factor deficiency. Patients may have spontaneous superficial bleeding i.e. petechial, purpura, epistaxis or GIT bleeding. In severe cases ecchymosis or intra-cranial haemorrhage can occur.

Hypotension Shock: Patient will have hypotension, cold clammy extremities, tachycardia, thready pulse. JVP is either normal or decreased. Echocardiography reveals normal systolic function of left ventricle hence hypotension is due to either dehydration or peripheral vasodilatation.

Arrhythmias: Patient presents with palpitation and syncope & irregular pulse. Common arrhythmias seen are supraventricular tachyarrythmias and various degrees of A.V. blocks. Ventricular tachyarrhythmias are infrequent. ST Segment depression and T wave inversion may be present in some patients.

All patients with severe , multiple organ involvement should be referred to tertiary care centres.

Summary of organs affected in Icteric Leptospirosis

Organ	Clinical features	Investigations reveal
Kidney	Decrease in urine output, features of uremia	Increase in Serum Creatinine, Increase in Blood Urea
Liver	Jaundice, hepatomegaly	Increase in Serum Bilirubin with normal or mildly elevated SGPT and SGOT and increased CPK
Lungs	Cough, haemoptysis, dyspnoea with increase in respiration rate and basal creps	X ray chest shows lower and mid zone opacities.
Heart	Hypotension, irregular pulse	ECG reveals the type of arrhythmia
Blood	Bleeding tendencies	Decrease in platelet count
Brain	Altered consciousness with neck rigidity	CSF shows increase in cells, increase in protein, normal sugar

9. Differential diagnosis

Falciparum malaria, dengue heamorrhagic fever and viral hepatitis closely resemble leptospirosis and are prevalent in areas reporting Leptospirosis. The correct diagnosis need to be established before initiating appropriate treatment, viz. antimalarial for falciparum malaria, antibiotics for leptospirosis and supportive treatment for dengue heamorrhagic fever and viral hepatitis.

10 Recommended case definition

10.1 Clinical description

Acute febrile illness with headache, myalgia and prostration associated with any of the following:

- Conjuctival suffusion
- Meningeal irritation
- Anuria or oliguria and/or proteinuria
- Jaundice
- Hemorrhages (from the intestines; lung bleeding is notorious in some areas)
- Cardiac arrhythmia or failure
- Skin rash and a history of exposure to infected animals or an environment contaminated with animal urine.
- Other common symptoms include nausea, vomiting, abdominal pain, diarrhoea, arthraliga.

10.2 Case classification

Suspected: A case that is compatible with clinical description.

Confirmed: A suspect case with positive laboratory test.

11. Laboratory criteria for diagnosis

Isolation (and typing) from blood or other clinical materials through culture of pathogenic leptospires.

Positive serology, preferably Microscopic Agglutination Test (MAT), using a range of Leptospira strains for antigens that should be representative of local strains.

11.1 Collection and Transportation of serum sample

While collecting blood and separating serum proper procedures should be followed to avoid lysis or contamination. The important steps are

- use sterile syringe and needle
- collect 5 ml blood

- transfer from syringe to sterile vial after removing needle
- syringe, needle and vial must be dry
- allow to stand at room temperature for 2-6 hours. Do not shake
- separate serum by dislodging retracted clot with a sterile pasteur pipette. If facilities for serum separation are not available then refrigerate at + 4-8^0 C. Samples should not be frozen.
- Transfer the liquid portion to sterile centrifuge tube. Centrifuge at 3000 rpm for 5 mins.
- Transfer supernatant (serum) to sterile plastic disposable leak proof screw capped vials. Add 5 µl of 1% solution of Sodium azide, if available, per 1 ml of serum sample. Store and transport at + 4-8^0 C in vaccine carriers/ice box. If transportation in the cold chain is not possible then use quickest mode of transportation.

11.2 Labelling and transportation of the sample

Each sample should be properly labelled mentioning name, date of collection, first serum sample or second serum sample and accompanied with a duly filled proforma with relevant clinical details should be included. The specimen should be kept cool preferably at 4- 8^0 C and sent to laboratory as early as possible. In case of delay, the sample should be stored at 4- 8^0 C before transporting to the laboratory.

11.3 Collection of clinical samples for isolation of leptospires

The isolation of leptospires from clinical specimens is the backbone of diagnostic work and it confirms the clinical diagnosis of the disease. Leptospires can be isolated from a variety of clinical specimens such as

- blood
- urine
- CSF
- Other specimen include autopsy tissues such as kidney or liver.

Collection of all the samples should be done taking recommended universal precautions. Gloves should be used at all times for personal protection.

11.3.1 Blood culture

Ideal time:

- Within 10 days of the onset of the disease.
- Sample should be collected before antibiotics are started.

Media:

EMJH, Fletcher's and Stuart's (commercially available or obtain from the designated regional/ district laboratory)

Procedure:

- Swab the area with the spirit
- Draw the blood using sterile syringe and needle by vein puncture
- Take 2 tubes containing 5 ml EMJH medium and inoculate two drops of blood in the first tube and four drops in the second tube.
- Incubate at 30^0C for 4-6 weeks.
- Examine the culture using dark field illumination initially on 1^{st}, 3^{rd} and 5^{th} days followed by at 7-10 days interval upto 6 weeks.
- Selective culture media containing 5FU 50-1000 µg/ml or a combination of nalidiocic acid 50 µg/ml; vancomycin 10 µg/ml and polymixin B sulphate 5 units/ml or a combination of actidione 100 µg/ml, bacitracin 40 µg/ml, 5-FU 250 mg/ml, neomycin sulphate 2 µg/ml, polymixin B sulphate 0.2 µg/ml and refampicin 10 µg/ml can be used to avoid the contamination.

11.3.2 Urine culture:

Time: 10-30 days after the onset of the disease

Media: Same as above

Procedure:

- Collect fresh midstream sample. The sample should be tested within 2 hours of collection.
- Dilute the urine as follows: using sterile test tubes and sterile phosphate buffer (pH 7.2).

(a) Add 0.4 ml of urine to 3.6 ml of PBS (1in 10)
(b) Add 3 ml of (a) to 3 ml of PBS (1 in 20)
(c) Add 2 ml of (b) to 2 ml of PBS (1 in 40)
(d) Add 1 ml of (c) to 1 ml of PBS (1 in 80)

- Take 5 ml of medium in 4 separate tubes and add 0.5 ml each of a, b, c, d solutions of PBS in 4 different medium tubes.
- Label tubes with dilution
- Incubate at 30^0C
- Examine the culture using dark field illumination at intervals of 7-10 days upto 6 weeks.

The above procedure should be repeated 2 or 3 times with urine samples collected at/on different times/days to increase the probability of isolation.

Urine can be filtered (through 0.22 µm filter) and/or inoculated into selective culture media to avoid contamination.

11.3.3 CSF Culture

Time: Within 5 - 10 days of the onset of the disease

Medium: As above

Procedure:
Inoculate 0.5 ml of CSF into 5 ml of culture media
Follow the same procedure as blood culture

11.4 Labelling and transportation of the samples

The specimen should be kept at room temperature and sent to laboratory as early as possible. In case of delay the sample should be stored at room temperature before transporting to laboratory.

12. Diagnosis

The definitive diagnosis of leptospirosis depends on sero-conversion or four fold rise in antibody titer or isolation of leptospires from clinical specimen.

12.1 Serological Diagnosis of Leptospirosis

12.1.1 Genus specific tests include ELISA & rapid immunodiagnostic tests (Lepto Dip-stick, Lepto Lateral Flow, Lepto Tek Dri-dot)

a) Enzyme Linked Immuno Sorbent Assay (ELISA)

Sensitivity and Specificity:

ELISA is a sensitive and specific test for the immunological diagnosis of Leptospirosis. It is of particular value as a serological screening test because of its relative simplicity in comparison to the MAT (Microscopic Agglutination Test). ELISA test can also be used in epidemiological studies to determine the sero-incidence/sero-prevalence of Leptospirosis

b) Rapid immunodiagnostics:

Lepto dip-stick, Lepto lateral flow and Lepto Tek Dri Dot assays are based on IgM detection.

These are screening tests and the results require confirmation by MAT.

Note:

1. The sero-diagnostic tests being used for Leptospirosis has shown cross-reactivity with hepatitis E and A. Thus, caution is necessary in the interpretation of serological data.
2. The health facilities undertaking sero-diagnosis should send 5% of their sera samples to the designated laboratory for cross-verification to ensure correct diagnosis.

The diagnostic tests to be carried out at different health facilities are as follows

12.2 CHC / District Hospitals

1. Detection of IgM antibodies against leptospires by rapid screening tests.
2. Hematology and urine analysis gives an indication if following changes are observed
    - Total WBC count slightly elevated with neutrophilia
    - Increased erythrocyte sedimentation rate (about 60 mm)

- Thrombocytopenia
- Increased BUN and serum creatinine
- Sodium potassium - normal or slightly reduced
- Urine analysis for proteinuria, hematuria and casts
- Increase in serum bilirubin (predominantly direct) levels.
- Alkaline phosphatase, SGOT and SGPT moderately elevated.
- Marked elevation in serum creatinine phosphokinase (CK) and MB variant.

12.3 Endemic states/tertiary level health care facility

1. ELISA
2. Microscopic Agglutination Test (MAT)
3. Isolation
4. PCR

13. Laboratories where facilities for diagnosis are available:

1. RMRC (ICMR), Port Blair – 744 101 (A&N) Tel: 03192-251158/251159
2. NICD, 22-Sham Nath Marg, Delhi – 110054 Tel: 011-23971272/23971060/ 23912901
3. Bacteriology & Mycology Division, IVRI, Izatnagar, UP, 243122 Tel: 0581-2301865
4. DRDE, Gwalior (MP) Tel: 0751-2340730; 0751-2341550

14. Leptospirosis – Treatment

14.1 Treatment at PHC (in leptospirosis endemic areas)

STEP – I : How to clinically suspect Leptospirosis?

- All patients presenting with fever and any two of the following (1) Myalgia (2) Conjunctival suffusion (3) history of contact with animals or farmer by occupation – should be clinically suspected for Leptospirosis

STEP- 2 : How to treat clinically suspected Leptospirosis?

- All clinically suspected leptospirosis patients in Leptospira endemic area

during rainy season should be given presumptive treatment of leptospirosis and Malaria i.e.

(1) Tab. Doxycycline 100 mg twice daily for 7 days .
(2) Tab. Chloroquine 600 mg stat in malaria endemic areas in adults and 10 mg/kg stat for children.

***Note**: In children less than 6 years 30 to 50 mg/kg/day of Cap. Amoxycillin/Cap. Ampicillin should be given in divided doses 6 hourly for 7 days.*

STEP- 3: Treatment at PHC for mild disease and rapid immunodiagnostic test positive cases

- All such patients should be given Inj. Crystalline penicillin 20 lacs i.u. i.v. every 6 hrly after negative test dose (ANTD) in adults for 7 days.
- For children the dose of crystalline penicillin should be 2 – 4 lacs units/kg/day for 7 days.

STEP – 4: How to treat patients with negative ELISA and negative rapid immunodiagnostic test and clinically stable ?

- Tab. Doxycycline 100 mg twice daily for 7 days.

STEP – 5: When to shift patients to higher centre?

All suspected leptospirosis cases whether positive or negative with rapid immunodiagnostic test having feature of organ dysfunction as follows should be IMMEDIATELY shifted to higher centre.

(1) Hypotension
(2) decreased urine output
(3) Jaundice
(4) Haemoptysis or breathlessness
(5) Bleeding tendency
(6) Irregular pulse
(7) Altered level of consciousness

While shifting patients to higher centre, individual patient's record should be furnished in the following order

- Age, Sex,
- Occupation- Rice field planters, sugarcane and pineapple harvesters, workers engaged in canal cleaning operations, livestock handlers, sewer workers, fishermen and swimmers etc.
- Clinical symptoms
- Date of onset
- Serological result
- Hospitalization details-treatment given

14.2 Treatment at CHC/District Hospital

STEP – I : How to clinically suspect Leptospirosis?

All patients presenting with fever and any two of the following

(1) Myalgia
(2) Conjunctival suffusion
(3) History of contact with animals or farmer by occupation – should be clinically suspected of Leptospirosis

STEP- 2 : How to treat clinically suspected Leptospirosis?

All clinically suspected leptospirosis patients should be given presumptive treatment of leptospirosis and Malaria i.e.

(1) Tab. Chloroquine 600 mg stat.
(2) Tab. Doxycycline 100 mg twice daily for 7 days.

STEP – 3: Laboratory screening of all suspected leptospirosis cases by rapid immunodiagnosis test:

Certain rapid tests are available for diagnosis of leptospirosis. They do not require expertise or any expensive instruments. However, they require confirmation by ELISA.

STEP- 4 : Treatment at CHC for mild disease and rapid immunodiagnostic test positive

All such patients should be given Inj. Crystalline penicillin 20 lacs iv every 6 hrly after negative test dose. (ANTD)

STEP – 5 : How to treat patients with negative ELISA and negative rapid immunodiagnostic test and clinically stable cases?

- Complete 7 day course of doxycycline.
- In children less than 6 years Cap. Amoxycillin/Cap. Ampicillin should be given in the dose of 30 – 50 mg/kg/day

STEP – 6 When to shift patients to higher centre?

All suspected leptospirosis cases whether positive or negative with rapid immunodiagnostic test having feature of organ dysfunction as follows should be IMMEDIATELY shifted to higher centre.

Renal:	Decreased urine output (< 400 ml per day)
	High blood urea (> 60 mg. %)
	High S. Creatinine(> 2.5 mg%)
	Clinical features of uremia, breathlessness, convulsion, delirium, and/ or altered level of consciousness
Hepatic:	Deep jaundice
	High S.Bilirubin(>3.0m.g. %)
Pulmonary:	Breathlessness
	Haemoptysis
	Increased respiratory rate
	X- ray chest showing opacities
Blood:	Bleeding tendency
	Low platelet count
Neurological:	Altered level of consciousness

While shifting patients relevant clinical profile along with the treatment given (as detailed under heading –Treatment at PHC) should be furnished

14.3 Treatment at medical college/tertiary level treatment facility

Treatment of leptospirosis is divided in two parts i.e. chemotherapy & organ specific care.

14.3.1 Chemotherapy

It should be started as early as possible. Guidelines for chemotherapy are as under:

Any case of fever (In leptospira endemic areas during rainy season):

Adults: T .Chloroquine 600 m.g. stat; Children: Tab. Chloroquine 10 mg/kg stat

Adults: T. Doxycycline 100 m.g. twice a day for seven days; Children : < 6 yrs. Cap. Amoxy/Ampicillin

14.3.2 Organ Specific care at tertiary level treatment facility

- Renal
- Hepatic
- Pulmonary
- Cardiac
- Haematological
- Neurological

In general, the treatment of these organ involvements does not differ much from the same manifestations due to non leptospiral causes.

14.3.2.1 Renal

- Mild Renal Involvement
  - When patients have only proteinuria and no signs of azotemia then we have to observe the patient and only chemotherapy against leptospirosis is to be given.
- Severe renal involvement (acute renal failure)
  - Correction of hypovolemia by normal saline: if after correction of volume deficit urine output is not adequate then following treatment should be started.
  - **Fluid Management**: Input = urine output + insensible loss (roughly around 500-700ml (or 400ml/sq mt.+ urine output of previous day); depending on temperature of environment and patient's respiration).
  - **Diet and Nutrition**: Adequate calories (1000 Kcal + 100 Kcal/year of age); with sodium, potassium and phosphorus restriction.
  - **Avoidance of Nephrotoxic Drugs:** NSAIDS, Tetracycline, Vancomycin, Aminoglycosides should be avoided. Dosages of commonly used antibiotics e.g. PenicillinG, Doxycycline, Ampicillin have to be reduced in severe azotemia.

- Additional renal insults like hypovolemia , hypotension, infection should be avoided.
- Complications of renal failure should be promptly diagnosed and treated.
- **Dialysis**: Peritoneal or hemodialysis is indicated in following conditions:
  - Fluid overload, hyperkalemia, and acidosis refractory to conservative treatment.
  - Clinical features of uremia.
  - Neurological conditions like : Encephalopathy, lethargy, seizures, myoclonus, asterixis.
  - Pericarditis

14.3.2.2 Hepatic

- Death due to hepatic failure is rare in leptospirosis.
- General measures to be taken:
  - Diet and Nutrition : Provide adequate calories
  - High carbohydrate diet with plenty of glucose
  - Protein restriction in severe cases
- Following precipitating factors for hepatic encephalopathy should be avoided and/or promptly corrected.
  - Drugs and Toxins: Avoid sedatives, hypnotics, tranquilizers and opiod drugs. Avoid hepatotoxic drugs like isoniazide, rifampicin, pyrazinamide, and paracetamol. Alcohol should also be avoided.
  - Hypovolemia to be avoided
  - Hypokalemia and alkalosis (Diuretics and Diarrhoea)
  - Constipation
    - Upper GIT Hemorrhage: Promptly remove the blood from gut by Ryle's Tube aspiration and bowel wash. Transfuse fresh blood or fresh frozen plasma.
  - Surgery
- Hepatic encephalopathy
  - Lactulose : 15-45 ml bid or qid initially and then to be adjusted to produce three to five stools per day.

- Antibiotics: Adults: Ampicillin 2 gm 6 hourly; Children: Ampicillin 200 mg/kg/day 6 hourly
- Metronidazole 250 mg per orally three times per day or Neomycin 1 gm orally every six hours.

14.3.2.3 Pulmonary

- Continuous oxygen therapy.
- Mechanical ventilation with positive end expiratory pressure (P.E.E.P.) if respiratory failure develops.

As this is the commonest cause of death and as the disease progresses very rapidly, these patients should **be immediately** shifted to a Tertiary care centre.

14.3.2.4 Cardiac

- Shock: Most common cause is hypovolemia and responds to fluid replacement.
- Vasopressors in the form of dopamine & dobutamine are indicated if blood pressure is not restored in spite of fluid replacement
- Cardiac arrhythmias
  - Cardiac monitoring
  - Treatment of specific arrhythmia.

14.3.2.5 Hematological

- Thrombocytopenia**:**
  - Platelet rich plasma or platelet concentrate.
- Coagulation defect
  - Injection vit k 5-10 mg i.v. for 3 days corrects the increased prothrombin time Fresh blood Or fresh frozen plasma.
- Disseminated intravascular coagulation (DIC**)**
  - Fresh frozen plasma
  - Fresh blood

14.3.2.6 Aseptic Meningitis

- Symptomatic and supportive management

15. Prevention and control

Prevention of leptospirosis is based on the control of reservoir hosts by means of environmental and personal hygiene. Control measures against leptospirosis should comprise of–

15.1 Protection of people against contagion by available means

Hygienic methods such as avoidance of direct and indirect human contact with animal urine are recommended as preventive measures. Workers in flooded fields should be cautioned against direct contact with contaminated water or mud and should be advised to use rubber shoes and gloves. In case of any cuts or abrasion on the lower extremities of the body, the worker should apply an antiseptic ointment e.g. betadine, before entering the field and after exit.

15.2 Health education

The main preventive measure for leptospirosis is to create awareness about the disease and its prevention. This has to be carried out by an intensive educational campaign.

15.3 Vaccination of animals

Leptospiral vaccines confer a limited duration of immunity. Boosters are needed every one to two years. Vaccination should however be very selective and used only in endemic situations having high incidence of leptospirosis. The vaccine must contain the dominant local serovars. While this prevents illness, it does not necessarily protects from infection and renal shedding. Details of vaccines available are listed below:

Species	Name of the vaccine	Company
Dog	Novivac-DHPPI-2L Eurican-DHPPI-2L Vanguard-DHPPI-2L Duramax-DHPPI-2L	Intervet, Norway Merial, France Pfizer, Animal Health, USA Fortdodge Lab, USA
Cattle	Leptavoid Spirovac Leptoferm-5	Schering Plough Animal Health, UK USDA, USA USDA, USA
Cattle & swine	Farrowsure-Plus	Pfizer Animal Health, USA

15.4 Rodent control

It is established beyond doubt that rodents are the major reservoirs of bacterium *Leptospira interogans* with more than 200 serovars. Possibly in a human infested area, where significant number of Leptospira cases are reported, selective rodent control measures should be undertaken.

15.5 Mapping of water bodies for establishing a proper drainage system

The mapping of water bodies and human activities in water logged areas should be carried out. This will help to identify the high risk population. Farmers may be educated to drain out the urine from the cattle shed into a pit, instead of letting it flow and mix with water bodies (rivers, ponds etc.)

15.6 Health impact assessment of developmental projects

Health impact assessment should be made mandatory for all developmental projects along with environmental assessment

15.7 Leptospirosis should be made a reportable disease in all endemic states.

15.8 Chemoprophylaxis

During the peak transmission season Doxycycline 200 mg, once a week, may be given to agricultural workers (eg. paddy field workers, canal cleaning workers in endemic areas) from where clustering of cases has been reported. The chemoprophylaxis should not be extended for more than six weeks.