

# Leptospirosis in Fiji: A Literature Survey

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## ABSTRACT

The compilers of this annotated literature checklist on Leptospirosis in Fiji carried out an extensive survey of literature. Of the 29 articles mentioned, six were published overseas. The majority of the articles were from the Fiji Medical Journal and the Fiji School of Medicine Journal. The abstracts were written with emphasis on Leptospirosis. Where available authors' abstracts and summaries were used.

*Biumaiwai M; Bavadra T; Olakowski T*

**Population, Morbidity and Mortality in Fiji during the last 100 years; Material for WHO Inter country Seminar on strengthening of Epidemiological Surveillance System and Utilization of Existing Health Board in Pacific Island country, Kingdom of Tonga, 4-10 February 1984, Suva, Fiji, 1984.**

A brief mention of leptospirosis is made in this report. Notifications for 1946-80 show that no cases were notified before 1970 except for a single case in 1956. Since 1970 cases have been notified every year. In 1980, 21 cases were notified giving an annual incidence of 3.3 per 100,000.

*Buadromo S; Hawley V G; Ram P*

**Leptospirosis in animals.**

**Fiji Med. J. 1981; 9(4/5): 86-89.**

In the five year period from January 1976 to December 1980, 127 cases of uveitis were seen at the Colonial War Memorial Hospital. Of these, 45 were due to leptospirosis. Characteristically leptospirosis affects the anterior uveal tract giving rise to iritis or iridocyclitis. Most of those affected were young adult males. Single acute episode of uveitis was the most frequent course observed in 39 (87%) cases; recurrent and chronic types were rare. The prognosis was good; all except one made complete recovery.

*Clarkson, D J*

**Leptospirosis in animals.**

**Lecture given at the FMA Annual Seminar, Hoodless House, September 1984.**

Leptospirosis in animals in Fiji is reviewed. The disease in animals is of minor importance with only sporadic cases of acute icteric disease in dogs and occasional abortions in pigs. The infection in domestic and wild animals is a significant reservoir of leptospires leading to human infection. Serological studies showed a high prevalence of leptospiral antibodies in dogs (57%), rats (55.8%), Mongoose (53.1%) and mice (40%) and relatively low prevalence in cattle (27.5%), sheep (17.1%), goats (10.3%) and pigs (10%).

The important reservoir hosts are dogs, rats, mongoose and mice with the major infecting serovars being *L. copenhageni*, *L. ballum* and *L. bratislava*. On culture the following serogroups were identified, dogs — *Icterohaemorrhagiae* and *Canicola*, in rats — *Icterohaemorrhagiae* and *Australis* and in mongoose, *Australis*.

*Collings, D F*

**Leptospira interrogans infection in domestic and wild animals in Fiji.**

**N.Z. vet. J. 1984; 32: 21-24.**

Clinical and serological evidence has indicated that human leptospirosis in Fiji is an important disease, and the prevalence of antibody is exceptionally high. A serological survey of the rural population showed that only 12% of the people studied did not have complement fixing (CF) leptospiral antibody. As the origin of this infection could not be explained by the known distribution of leptospiral infection in domestic and wild animals, a serological survey using the complement fixation test

(CFT) was undertaken as the first stage of an epidemiological investigation into human and animal leptospirosis.

Sera from domestic and wild animals were tested for CF antibody to 17 leptospiral serovars, namely: *pomona*, *copenhageni*, *grippotyphosa*, *hardjo*, *ballum*, *tarassovi*, *canicola*, *australis*, *bratislava*, *autumnalis*, *pyrogenes* and *bataviae*. Antibody was detected in 27.5% of 480 cattle, 17.1% of 70 sheep, 10.3% of 252 goats, 10.0% of 480 pigs, 57.0% of 100 dogs, 55.8% of 34 rats (*Rattus rattus*, *R. frugivorus*, *R. exulans* and *R. norvegicus*), 53.1% of 32 mongoose (*Herpestes auropunctatus*) and 40.0% of 10 mice (species unknown.)

Cross-reactivity precluded the identification of infecting serogroup with the exception of *pomona* in pigs and *icterohaemorrhagiae*, *ballum* and *australis* in dogs. Infection of dogs with a serovar of the austral serogroup may explain the predominance of serological reactions to *bratislava* in man.

The survey revealed a significant level of leptospiral antibody in all animal populations of Fiji and indicated that cattle, dogs, rats, mongoose and mice are probably the most important maintenance hosts. Consequently, further investigations will concentrate on the attempt to isolate leptospires from these species.

*Edmonds A R; Hawley T G*

**Leptospirosis in Suva**

**Fiji Sch. Med. J. 1967; 2(10): 6-7.**

In 1958-59 a small survey was carried out in Nabua settlement in Suva. Sera from 114 Fijians was tested for Leptospirosis antibodies by the agglutination method.

Antibodies to *L. icterohaemorrhagiae* were found in 10 (8.8%) and *L. australis* in 20 (17.6%). Except in the 0-4 years age group, antibodies were detected in all age groups and males and females were equally represented. They concluded that sub-clinical or atypical leptospiral infection in Fijians must be frequent and acquired at an early age and suggested research into animal reservoirs as well as routine screening of patients with pyrexia for leptospiral antibodies.

They also quote the results of the survey in cattle and dogs by the Fiji Veterinary Laboratory in 1965-66. Of 500 apparently normal cattle slaughtered at Tamavua, 22 (4.4%) had antibodies to *L. pomona* in a titre of 1/20 or greater.

Blood collected from 20 dogs with features of hepatitis or nephritis showed antibodies to *L. canicola* in three and to *L. icterohaemorrhagiae* in seven in a titre of 1/20 or greater.

*Faine S.*

**Leptospirosis: Epidemiological and surveillance services.**

**Assignment Report. Manila: WHO WPRO 1974, (WPRO 2902 (Fiji) (ICP/ESD/01).**

This report reviews the problem of human leptospirosis and the

diagnostic facilities available in Fiji.

The recommendations include upgrading of facilities, training of laboratory staff, surveillance and epidemiological studies to isolate leptospires from animal hosts and improvement of treatment facilities including dialysis.

A serological survey for antibodies to leptospires was undertaken. Sample included town and village groups, a school, hospital outpatients and blood sample populations. The family and work contacts of a patient in the Western Districts were also followed up.

Blood was taken from people in Suva (hospital bloods for other investigations), Ovalau (Levuka town population, villages of Baba, Vagadaci and Yaravudi); Lautoka district (Fijian villages at Naviago, Vatukoura, Loloma and Matanagata); Indian groups at Naikabula Road, Malele (Tavua), Rakiraki; Savusavu district (Fijian villages at Savudrodoro, Yaroi and Vivili; Banabans at Rabi Island); Labasa District (Hospital outpatients, mainly Indian; Tabia (Indian) and Fijians at Sasa village, Naduri and Nabala school.

A total of 852 blood samples were tested for leptospiral antibodies using L. biflexa Patoc I agglutination test to titres of 1:10 - 1:1000.

The presence of antibodies to leptospires was found to be widespread.

*Mitchell, R.*

#### **Acute renal failure in Fiji (Editorial).**

**Fiji Med. J. 1985; 13 (7/8): 140**

Editorial comments on the problems associated with the management of acute renal failure in developing countries and the importance of preventive measures.

The most frequent cause of acute renal failure in Fiji is leptospirosis. Serious cases of leptospirosis requiring hospital admissions are only the tip of the iceberg and there must be a high incidence of morbidity which can be attributed to the disease which should be controllable. The medical and primary health care workers should continue to educate the public on the control of leptospirosis through rodent control, occupational hygiene, treatment of infected animals and immunisation of domestic animals. The health care workers should be well versed with the clinical features of the disease enabling early diagnosis and referral for treatment.

*Munro, R.*

#### **Leptospirosis in the animal population in Fiji.**

**Fiji Med. J. 1978; 6(4): 79-80.**

The results of leptospira serology in animals for 1971-77 are reported. The macroscopic slide agglutination test was used. The majority of samples were from pigs and cattle from larger farms. Serology was positive in 0.3% of cattle (3/964), 2.2% of the pigs (80/3720), 1.7% of rats (1/58) and 21% of dogs (4/19). Serology was negative in a small number of goats (26) and mongoose (80) tested.

The initial recognition of porcine leptospirosis was made in 1971. L. pomona is the most common serotype to affect pigs. Acute disease is characterized by pyrexia, icterus and anaemia. Abortions are generally restricted to the chronic phase of the illness and occur during the final three weeks of gestation.

Leptospirosis in dogs is usually caused by L. canicola and manifest itself as acute, sub-acute or chronic interstitial nephritis. L. icterohaemorrhagiae is less common pathogen of dogs.

Bovine leptospirosis is not common or serious problem in Fiji.

*Pennington, A H.*

#### **The Zoonoses**

**Fiji Med. J. 1980; 8(9): 598-601.**

This article reviews various zoonoses, infectious diseases transmissible under natural conditions from vertebrate animals to man, in Fiji. Leptospirosis may be caused by any of many serotypes of the leptospira which are enzootic in Fiji, although the animal host has not yet been identified. Infection is acquired from the urine of infected animals which is present on grass. Most medical officers in Fiji are well aware of this condition and of the need for urgent treatment even if the animal host has not been identified.

*Ram, P.*

#### **Epidemiology of Leptospirosis in Fiji.**

**Fiji Med. J. 1978; 6(4): 70-72.**

In the period 1969-77, 240 cases of leptospirosis were reported from various parts of Fiji, with 72.5% of cases notified from the Southern districts. The majority of the cases occurred during or shortly after the rainy seasons. It is predominantly a disease of males aged 20-50 years. One hundred and ninety-one (79.6%) were in Fijians, 37 (25.2%) in Indians and 12 (4.9%) in other ethnic groups. Icterohaemorrhagiae, Australis and Canicola were the most frequent infecting serogroups. Of 149 patients for whom clinical data was available, 66.4% had severe hepatorenal failure, 22.8% septicaemic illness, 10% aseptic meningitis and one (0.7%) had bilateral uveitis. The case fatality rate was 8.0% (13/162).

From the information available the likely sources of human infection are dogs, pigs, cattle and rats.

*Ram, P.*

#### **History of leptospirosis in Fiji.**

**Fiji Med. J. 1978; 6(4): 68-69.**

History of leptospirosis in Fiji is reviewed. In 1952 a Fiji soldier developed a febrile illness with jaundice and renal failure shortly after arriving in Singapore. He was admitted to a military hospital and died with the diagnosis of leptospirosis. This was probably the first diagnosed case of leptospirosis acquired in Fiji.

In 1958-59 Edmonds and Hawley carried out a small serological survey in Nabua. The first clinically diagnosed and serologically confirmed case was seen at the CWM Hospital in 1969. He was a 29-year-old male labourer who was admitted with a three day history of fever, headaches, pains in the lower limbs, gastrointestinal symptoms and difficulty in walking. The illness was complicated by severe hepatorenal failure (serum bilirubin 26mg/100ml and blood urea 400mg/100ml) and bleeding from the gums, skin and microscopic haematuria. In the third week of the illness his condition gradually improved and he made a complete recovery. Leptospiral microscopic agglutination test revealed antibodies to L. icterohaemorrhagiae (serovar copenhageni).

Since then increasing number of cases were diagnosed in Suva and from other parts of Fiji. By June 1977, 240 serologically confirmed cases of leptospirosis were reported.

In 1974 Faine carried out a serological survey using L. biflexa Patoc I agglutination tests and found antibodies in titre of 1/10 - 1/100 to be widespread.

Studies carried out on animals at the Veterinary Laboratory between 1965 and 1977 showed leptospiral antibodies in cattle, dogs, pigs and rats.

*Ram, P.*

#### **Leptospira icterohaemorrhagiae infections.**

**Fiji Med. J. 1978; 6(4): 73-78.**

Features of 60 cases of Leptospira icterohaemorrhagiae infections seen over a nine year period (1969-1977) are discussed. The majority (75%) of the infections occurred in males and 73% were between the ages of 10-50 years. Forty-seven (83.3%) were in Fijians, 10 (16.7%) in Indians and three (5%) in other ethnic groups. The disease occurred mainly in those with frequent contacts with animals. Forty-three (71.7%) had severe hepatorenal failure, nine (15%) septicaemic illness, seven (11.7%) aseptic meningitis and one bilateral uveitis. The kidney was involved in 88.3%, liver 86.7%, central nervous system 50%, lungs 46%, heart 36.7% and haemorrhages occurred in 33.3%. Eye involvement was noted in 66.7%. Ten patients required peritoneal dialysis. The mortality rate was 6.7%.

*Ram, P.*

#### **Leptospiral Meningitis.**

**Fiji Med. J. 1982; 10 (5/6): 76-78.**

The clinical details of 23 patients with leptospiral meningitis seen during the 10 year period from January 1972 to December 1981 at the Colonial War Memorial Hospital are discussed. Sixteen were males and seven females; with majority being in the 15-49 years age group. All presented with clinical features of aseptic meningitis and in addition majority had either myalgia, conjunctival suffusion, evidence of bleeding, slight jaundice or raised blood urea levels. The infecting serogroups were Icterohaemorrhagiae, Canicola, Australis and Hebdomadis in 17 cases

and six had positive genus-specific Patoc agglutination test. There was one death due to encephalitis; the case fatality was 4.3%

*Ram, P.*

#### **Leptospirosis.**

**Fiji Med. J. 1974; 2(6): 171-175.**

The clinical features of human leptospirosis are described. The disease may present as a febrile or septicaemic illness (currently called anicteric leptospirosis), a severe illness with hepatorenal failure (Weil's disease) or as a meningitic illness. Aspects of laboratory diagnosis, treatment and prevention are briefly mentioned.

The first clinically diagnosed and serologically confirmed case was seen at the CWM Hospital in 1969. By the end of November 1973, a total of 46 cases had been treated at the hospital. Three had febrile illness, nine aseptic meningitis, 34 hepatorenal failure and their ages ranged from 12-73 years. Sixty percent of all cases had renal failure and of these one-third required peritoneal dialysis. There were two deaths. *L. Icterohaemorrhagiae* was the most common infecting serogroup. Leptospirosis had become the most common cause of acute renal failure in Fiji.

*Ram, P.*

**Leptospirosis: Synopsis of present knowledge. Presented at the Colonial War Memorial Hospital as lectures in 1980, subsequently included, in: "Guidelines for the Control of Leptospirosis" edited by Faine S, Geneva: WHO, 1982. (WHO Offset Publication No. 67).**

This is a detailed account of varied clinical manifestations, epidemiology, complications, differential diagnosis, diagnostic tests, treatment and the prognosis of leptospirosis in man.

*Ram, P.*

#### **Mortality in human leptospirosis.**

**Fiji Med. J. 1982; 10(5/6): 84-86.**

The causes of mortality in 353 cases of human leptospirosis seen at the Colonial War Memorial Hospital between 1969-1981 are analysed. Of 28 deaths there were 18 males and 10 females; the case fatality rate was similar in both sexes. Fijians had slightly higher mortality (8.7%) than Indians (5.2%). All deaths occurred in icteric cases, in whom the case fatality was 14%. Deaths were due to myocarditis in 12, renal failure in 10, severe bleeding in two, respiratory failure in two, encephalitis in one and severe toxæmia in another. Most of the deaths occurred towards the end of the first week and during the second week of the illness.

*Ram, P.*

#### **Subarachnoid haemorrhage in Leptospirosis.**

**Fiji Med. J. 1981; 9(6/7): 113-114.**

Subarachnoid haemorrhage, a very rare complication of human leptospirosis, is reported in a 21 year old male labourer. He was admitted with a five day history of fever, headaches, body pains and prostration. On the sixth day of the illness he had a generalized convulsion and developed signs of meningeal irritation and urinary retention. The spinal fluid was xanthochromic. From the seventh day of the illness his condition improved, he became afebrile, headache and signs of meningeal irritation subsided and he was able to walk.

On the 10th day of the illness fever recurred. On the 12th day when the fever was 30°C, he developed severe headache and marked signs of meningeal irritation. A lumbar puncture showed a uniformly blood-stained cerebrospinal fluid. By the 17th day of the illness he became afebrile, headache and the signs of meningeal irritation subsided. No petechiae or ecchymoses were noted. His further progress was uneventful and he was discharged on the 28th day of the illness.

*Ram, P.*

#### **Treatment of Leptospirosis.**

**Fiji Med. J. 1982; 10(5/6): 78-80**

The current treatment of leptospirosis is discussed. The treatment of all infecting serovars is the same and includes antibiotics, symptomatic and supportive therapy. The main aim of the chemotherapy is to abort the course of the illness and hence prevent complications and deaths. Once organ damage has occurred the course of the disease is unaffected by antibiotics. Antibiotics are effective when given early, in the first four to five days or before jaundice appears, in large doses parenterally i.e. 2

mega units of crystalline penicillin six hourly for five to seven days. Those allergic to penicillin can be treated with erythromycin or tetracyclines.

Pain and headaches can be controlled with analgesics, fever with antipyretics, and convulsions with intravenous diazepam. Fluid losses need to be replaced promptly.

In severe cases renal, hepatic, pulmonary and cardiac functions need to be supported. Mild renal failure is managed conservatively but worsening and severe renal failure will require dialysis. Both haemodialysis and peritoneal dialysis can be used. Thrombocytopenia is treated with platelet transfusion or with a short course of steroids. The success of the treatment depends as much on the standard and intensiveness of the nursing care as on all other measures.

*Ram, P; Beg M F; Kapadia V; Naidu V; Rao U; Nasarova J; Stephen G.*

#### **Acute renal failure in Fiji.**

**Fiji Med. J. 1985; 13(7/8): 142-149.**

Limited facilities for peritoneal dialysis became available at the Colonial War Memorial Hospital in 1966. In 1968 it was used for the first time to treat a 32 year old woman with acute oliguric renal failure.

Between 1968 to 1984 a total of 551 patients were treated for acute renal failure. Sixty-two (11.3%) were in obstetric patients, 49 (8.9%) in surgical and 440 (78.8%) in medical patients. The overall mortality was 25%; being 12.9% in obstetric, 23.4% in medical and 55.1% in surgical cases.

Of 440 cases of acute renal failure in medical patients, leptospirosis accounted for 45.9%, acute glomerulonephritis 21.8%, paraquat poisoning 9.6% and miscellaneous conditions 22.7%.

*Ram P; Beg M F; Kapadia V; Ram B; Rao G.*

#### **Renal failure in leptospirosis.**

**Fiji Med. J. 1985; 13 (7/8): 150-157.**

During the 16 year period from January 1969 to December 1984, 202 cases of acute renal failure due to leptospirosis were treated at the Colonial War Memorial Hospital, Suva. One hundred and thirty nine (69%) had oliguric and sixty three (31%) had non-oliguric renal failure. In the former, oliguria usually occurred between the fourth to seventh day of the illness. The mean oliguric period was six days.

Clinically the patient had severe illness with multiple organ system involvement. Hypertension, hyperkalaemia and fluid retention were rare.

*Icterohaemorrhagiae*, *Australis* and *Canicola* serogroups were the most common infecting serogroups, together accounting for 77% of all cases.

There were 36 deaths, a case fatality of 18%. The case fatality was higher in those over the age of 45 years. Myocarditis was the most frequent cause of death in 15 (42%).

*Ram P; Chandra M S.*

#### **Unusual electrocardiographic abnormality in leptospirosis: Case reports.**

**Angiology, 1985; 36(7): 477-482.**

Unusual ECG changes of marked ST segment elevation in leads V1 to V3 are reported in four cases of severe icteric leptospirosis for the first time. These changes normalized rapidly with initiation of therapy and recovery in three patients. One patient died within hours of admission. The causes for the changes are not clear. It is possible that leptospirosis caused severe localized vasculitis of the left anterior descending coronary artery resulting in oedema and transient obstruction or severe spasm in the left anterior descending coronary artery resulting in ECG changes similar to that seen in Prinzmetal variant angina. The observed changes could also be on the basis of localized myocarditis and pericarditis.

*Ram P; Collings D F.*

#### **Further observations on the epidemiology of leptospirosis in Fiji.**

**Fiji Med. J. 1982; 10(5/6): 71-75.**

This study is based on 487 cases of leptospirosis reported in Fiji between 1969 and 1981. The majority of cases of clinical leptospirosis occur during the rainy months, males aged 20-50 years are predominantly affected, ethnic distribution favours Fijians and *Icterohaemorrhagiae*, *Australis* and *Canicola* are the most frequent infecting serogroups. The

most likely sources of human infection are dogs, pigs, cattle and rats. Suggestions for further epidemiological studies are made.

*Ram P; Collings D F.*

**Leptospirosis in man and animals.**

**Fiji Med. J. 1982; 10(5/6): 66-70.**

The current knowledge regarding leptosiral infections in man and animals is reviewed. Leptospire are small, thin, motile, tightly coiled organisms. All pathogenic strains are obligate parasites. There are at least 165 pathogenic serovars or serotypes arranged in 18 serogroups.

Leptospire are parasites of a wide variety of wild and domestic animals. In relation to human disease the most important host species are rats, mice, dogs, pigs and cattle. Infection in these is often not severe but leads to a renal carrier state. They are shed in the urine and survive for long periods where environmental conditions are favourable (warmth, moisture and soil pH 6.2-8).

The transmission of leptospire to humans occurs most commonly indirectly via the contaminated environment and less often directly from contact with animal tissues or urine. They enter the body through the skin damaged by cuts, abrasions, soaking in water or through mucous membranes.

All serovars pathogenic to animals can cause human disease. The severity and clinical manifestations depend on the dose and the virulence of infecting serovars, host susceptibility and the organ systems predominantly involved.

There are no serovar-specific clinical syndromes. Generally the disease may present as a septicemic meningitic or severe illness with hepatorenal failure.

Infection in animals may result in an acute fatal disease, non fatal syndromes of varying severity and inapparent infection depending on the virulence of the infecting serovar and the susceptibility of the host. *L. icterohaemorrhagiae* infection in dogs often causes a fatal icteric syndrome with death occurring within 24-48 hours.

Acute illness in animals causes symptoms similar to those in man. However more unusual symptoms may be indicative infection with a specific serovar i.e. severe buccal ulceration seen in dogs with canicola infection, mastitis and abortion in cattle with hardjo and abortion in pigs with pomona. Nephritis is the only important chronic manifestation of leptospiral infection.

*Ram P; Karim I.*

**Severe psychiatric disturbance in Leptospirosis.**

**Fiji Med. J. 1981; 9(6/7): 115-117.**

The case histories of two patients with leptospirosis with severe psychiatric disturbance are described. The first patient developed acute delirium, vivid visual hallucinations and marked apprehension and the second patient developed paranoid psychosis during the septicemic phase of the illness. Both made complete recovery.

*Ram P; Lal V.*

**First isolation of leptospira from human case.**

**Fiji Med. J. 1982; 10(5/6): 81-82.**

In 1981 limited facilities for culture of leptospire became available at the

Colonial War Memorial Hospital. Leptospire were isolated from blood cultures of a 44 year old subsistence farmer from suburban Suva, who was admitted with a week's history of fever, rigors, body pains, myalgia and headaches. Semisolid EMJH media with 5-fluorouracil and without 5-fluorouracil was used. Cultures became positive at the end of the second week after inoculation. The leptospire were subcultured and sent to Brisbane for the identification of the serovar. Cross-agglutination absorption test showed that leptospire were of serovar copenhageni, of icterohaemorrhagiae serogroup.

*Ram P; Mataika J U; Metcalfe R V; Bettelheim K A.*

**Antibody levels to Brucella abortus, Toxoplasma gondii and Leptospira serogroups in sera collected from healthy people in Fiji.**

**Comp. Immun. Microbiol. infect. Dis 1982; 5(4): 397-403.**

A collection of 300 sera from a predominantly rural community on the island of Viti Levu in Fiji were studied for the presence of antibodies to *B. abortus*, *T. gondii* and *Leptospira* serogroups. Significant levels of immunity were found to *B. abortus* and *T. gondii* and over half the population had diagnostic leptospiral antibody levels.

*Ram P; Schramm M.*

**Leptospirosis and pregnancy.**

**Fiji Med. J. 1981; 9(10/11): 160-162.**

Four cases of leptospirosis during pregnancy are reported. The pregnancy continued for two, 12 and 20 weeks respectively in three patients, in spite of acute renal failure in one. The three infants were liveborn although one suffered from an unrelated abnormality (spina bifida). Stillbirth occurred in one case only during the acute febrile phase of the illness, and this patient was also the only one to require dialysis for renal failure.

*Singh K P; Seruwatu L M; Ram P*

**Autopsy findings in human leptospirosis.**

**Fiji Med. J. 1986; 14(1/2).**

Autopsy findings in 18 fatal cases of human leptospirosis are discussed. The major findings were bile staining of the tissues and haemorrhages. The organ systems most frequently involved were the lungs, heart, liver, kidneys, brain and the gastrointestinal tract. Haemorrhages in the pleura, lungs and the tracheobronchial tree were observed in 11; four had severe bilateral haemorrhagic pneumonia. Six had interstitial nephritis.

There was histological evidence of myocarditis in seven and fibrinous pericarditis in four. Severe adrenal haemorrhage was observed in one and another had subarachnoid and cerebral haemorrhages.

*WHO*

**Final report: Working group on the formulation of Leptospirosis guidelines.**

**Manila; WHO, WPRO 1981. [(WP) PDV/ICP/BVM/016.]**

Leptospirosis in the WHO Western Pacific Region including Fiji is reviewed. The working group also reviewed the Leptospirosis guidelines which was subsequently published "Guidelines for the control of Leptospirosis", Faine S ed. Geneva: WHO, 1982.

**NOTE**

Readers are requested to inform the compilers if they have contributed articles or are aware of publications on Leptospirosis, which are not included in this paper. It is intended to compile a supplementary list if necessary.