



Figure 4.—Tracings made during an attack of tachycardia four days after Figures 2 and 3.

3. *Facilities.* Equipment to begin dealing with the emergency should be located at each nursing station, x-ray department, recovery room, intensive care ward, nursery and emergency room. A sterile scalpel, a stethoscope and portable apparatus for the administration of oxygen under positive pressure should suffice.

Centrally located cardiac emergency equipment may be summoned along with the professional team. This should include surgical instruments and drapes, laryngoscopes and endotracheal tubes, drugs, a cardiac defibrillator and pacemaker and an electrocardiograph.

SUMMARY

In two recent cases of cardiac arrest in the hospital but outside the operating room, an alarm system summoned a well organized team who carried out cardiac massage and related treatment, saving both patients without any demonstrable brain damage. Both patients returned to work.

4025 Brockton Avenue, Riverside (Schlotter).

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A Case of Leptospirosis Ballum In California

RUTH A. BOAK, M.D.,
WILLIAM D. LINSKOTT, Ph.D., and
RALPH E. BODFISH, M.D., Los Angeles

IN RECENT YEARS leptospirosis has become recognized as a medical and veterinary problem of worldwide importance. A report by the United States Department of Agriculture²¹ estimated that bovine leptospirosis causes an annual loss of over one hundred million dollars to the American livestock industry. Although leptospirosis in man is reported relatively infrequently in the United States, in many parts of the world it is a significant military¹⁷ or occupational¹⁹ hazard. It would be difficult to determine whether the increased number of cases of leptospirosis reported in recent years is due to a rising incidence, to increased awareness of the disease, or to both.

Recognized human leptospirosis has usually been caused by *Leptospira canicola*, *L. icterohaemorrhagiae*, or *L. pomona* in the United States, where the principal reservoirs of infection are dogs, rats and cattle and hogs. The only other serotypes implicated in naturally acquired human leptospirosis in this country have been *L. australis A* (one serologically confirmed case),¹⁸ *L. autumnalis* (sharply localized outbreaks of "Fort Bragg fever" in North Carolina in 1942, 1943 and 1944),⁷ *L. Ballum* (among workers in a single research laboratory),²⁰ *L. bataviae* (one serologically confirmed case),⁶ *L. grippotyphosa* (three serologically confirmed cases),^{1,4} and the *L. pyrogenes* group (one serologically confirmed case).²² Only *L. canicola*, *L. icterohaemorrhagiae*, and *L. pomona* have been reported in California, in man or in animals.

LEPTOSPIROSIS IN CALIFORNIA

Meyer, Eddie and Anderson-Stewart¹⁵ were the first to report leptospirosis in California, in 1938. They found that about one-third of the rats in

Department of Infectious Diseases, School of Medicine, University of California, Los Angeles 24, and Department of Isotopes, Veterans Administration Hospital, Long Beach.
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northern California showed darkfield evidence of leptospirae in their kidneys. Twenty-two cultures of leptospirae isolated from rats in this area were identified as *L. icterohaemorrhagiae*. These investigators also reported serologically confirmed Weil's disease among San Francisco sewer workers, and were the first to report the presence of a serotype other than *L. icterohaemorrhagiae* in the United States. Seven strains of leptospirae which they isolated from jaundiced dogs in northern California were identified as *L. canicola*.

In 1939, Meyer, Eddie and Anderson-Stewart¹⁶ reported that nearly one-fourth of a group of dogs taken at random in Northern California had significant titers of agglutinins for *L. canicola*. In addition, a strain of leptospira isolated from a case of febrile meningitis in a dog-pound worker was proven to be *L. canicola*. In 1941, Greene⁸ noted that about 20 per cent of dogs taken at random in Southern California had serum agglutinins for *L. canicola*.

The *L. pomona* serotype was first isolated in California by DeLay, Howarth and Eddie,³ who found the organism in cattle in 1955. In the same year, Grossman, Levin and O'Neill⁹ reported two serologically confirmed human cases of *L. pomona* meningitis in California. One patient was a pig ranch owner, the other dug trenches in a field where there were many cattle. Howarth¹⁰ recorded positive reactions to *L. pomona* in 11 per cent of 5,619 bovine sera, 18 per cent of 1,216 porcine sera, and 19 per cent of 21 equine sera submitted for help in diagnostic problems by California veterinarians over a period of five years. In addition, 21 per cent of 340 canine sera contained *L. canicola* agglutinins. More recently, the Los Angeles County Livestock Department reported¹¹ that 26 per cent of 163 bovine sera tested were positive for leptospirosis (presumably *L. pomona*) and that *L. canicola* was implicated serologically in an outbreak of gastroenteritis among the animals of a large goat dairy.¹²

The California Public Health Statistical Report for 1957² listed 34 cases of probable leptospirosis in man from 1949 to 1957. The diagnosis in 23 of these cases was based on increasing serological titers, clinical symptoms and epidemiological evidence. Of the 23 cases, five were attributed to *L. icterohaemorrhagiae*, eleven to *L. canicola*, and seven (since 1951) to *L. pomona*. In four the organism was not classified.

Although *L. ballum* has been known to cause human leptospirosis in other parts of the world, it was only recently that Stoenner and Maclean²⁰ reported the first human infections caused by this serotype in the United States. These cases involved eight out of 58 persons in one laboratory who had frequent contact with Swiss albino mice. Many of these mice (80 per cent of the breeding females) were excreting *L. ballum* in their urine. The following is a description of the first case of leptospirosis due to *L. ballum* to be reported in California.

CASE REPORT

The patient was a 57-year-old man, a laboratory assistant who had routinely handled experimental animals including rabbits, guinea pigs, rats and mice. For some time before he became ill he had worked only with mice and rats, and he had frequently been bitten by them. His illness began with headache and malaise, which progressed to migrating myalgia, high fever (104° F.), anorexia, arthralgia in the knees and pain in the legs, chest and back. During the next few days he noted increased severity of these symptoms and the appearance of moderate conjunctivitis, testicular pain and "dark foamy urine." The patient was given an unspecified antibiotic by a physician on the fifth day of illness, and he became afebrile in about a week. The total duration of illness was ten days.

Leptospirosis was not initially considered, but after the patient returned to work it was thought that an examination should be made for Weil's disease because of the history of frequent contact with rats and mice. Blood specimens were taken 23, 59 and 158 days after the onset of illness. The first two specimens were submitted to the Communicable Diseases Center at Atlanta, Georgia, where they were examined by the "agglutination-lysis" test with 11 different leptospiral serotypes. The results were reported as follows:

	Agglutination Lysis Titers			
	<i>L. ballum</i>	<i>L. canicola</i>	<i>L. icterohaemorrhagiae</i>	All Others
23-day specimen	1:512	1:128	1:32	Negative
59 day specimen	1:128	Negative	Negative	Negative

After the final blood specimen was obtained, all three sera were tested simultaneously in our laboratory, and "agglutination-lysis" titers against *L. ballum* of 1:512, 1:256 and 1:128, in chronological order, were found.

DISCUSSION

The cases of leptospirosis *ballum* reported by Stoenner and Maclean²⁰ were characterized by headache, fever (104-105° F.), weakness, chills and sweats and various manifestations of myalgia. These investigators were the first to associate orchitis with leptospirosis; they found this symptom in each of the four clinical cases they reported in detail. In their series, orchitis appeared two to four weeks after onset, as compared with five days in the present case. They reported no conjunctivitis, which however, is quite commonly associated with human leptospirosis.

A complicating factor in the present report is the fact that the patient had had testicular pain six years previously, in Korea. After it subsided, a scrotal mass was discovered, which is still present.

It is still fairly common practice to include only the three major serotypes in screening sera for leptospirosis in this country; in veterinary medicine, often only *L. pomona* is used. However, several sur-

veys recently have shown that additional serotypes are endemic among wild animals in certain areas in the southern and eastern United States. The following serotypes have been cultured from such animals as mice, raccoons, opossums, foxes, skunks and wildcats: *L. australis*,^{5,13} *L. autumnalis*,¹⁴ *L. ballum*,¹³ *L. grippotyphosa*,¹³ *L. pomona*,¹³ the *L. hebdomadis* group,¹³ and the *L. mitis-L. hyos* group.^{5,13} Until routine testing can be done for all the serotypes that have been implicated in leptospirosis in this country, the true incidence will not be known.

Although the maximum titer to *L. ballum* found in the case reported herein is not high, the declining titer and the clinical history combine to make plausible the assumption that the illness was caused by this serotype of leptospira. The possibility remains that the actual serotype may have been a new or unexpected one related to *L. ballum*, and that the titers observed were owing to cross-reactions.

SUMMARY

A laboratory assistant who routinely handled rats, mice, rabbits and guinea pigs became ill with symptoms which were similar to those often reported in mild leptospirosis. The serologic evidence and the clinical history are compatible with a retrospective diagnosis of leptospirosis due to infection with *Leptospira ballum*. This is the first reported evidence for the presence of the *L. ballum* serotype in California.

Department of Infectious Diseases, UCLA Medical Center, Los Angeles 24 (Boak).

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