not be correlated with any similar fluctuations in the chemistry or the cytology of the cerebro-spinal fluid.

The patient was discharged cured on October 17th, 1933, after a stay of practically six weeks in hospital. Since her discharge she has had no recurrence of meningeal involvement, and at the present time she is able to undertake her normal household duties, and seems to be enjoying good health. She has not, apparently, experienced any recurrence of the original attacks of presumptive gall-bladder trouble, which first brought her to the Queen's Hospital.

The significant treatment consisted in the complete drainage of the cerebro-spinal fluid by repeated lumbar puncture, and the rectal injection of four ounces of a 25 per cent. solution of magnesium sulphate, morning and evening, for the first eight days after admission.

DISCUSSION

It would appear to be certain that the meningeal infection was connected with the intrathecal injection of the spinal anaesthetic. The patient exhibited no signs or symptoms of any intestinal infection when she was first examined, and the complete absence of fever and her general good condition negative any likelihood of a pre-existing generalized infection with *B. pyocyaneus*. At no time, also, had she any signs of a middle-ear or nasal sinus infection.

The exact source of the infection has not been established, but contamination of the percaïne is a more likely event than contamination of the syringe or needle used in the intrathecal injection, especially in view of Wilson's observation, to which I have already referred. Unfortunately, the sample of percaïne was not submitted for laboratory examination, and, in the absence of bacteriological proof of the contamination of the percaïne with *B. pyocyaneus*, the exact source of the infection remains a matter for conjecture. This case, however, has several educational bearings—notably, the low virulence of a *B. pyocyaneus* infection of the meninges in a previously healthy adult, and the warning that it provides of the need for scrupulous asepsis and absolute sterility in the use of medicaments and apparatus for therapeutic purposes. Had the infecting agent been *Staphylococcus aureus* or *Streptococcus pyogenes* the final result would certainly not have been so favourable.

I wish to record my indebtedness to Dr. A. V. Neale, honorary assistant physician to the Queen's Hospital, under whose care the patient recovered in the medical wards, for his kind permission to publish the clinical notes of the case, and to Dr. H. I. Coombs, Ph.D., biochemist to the Queen's Hospital, for his kind permission to include the chemical findings on the cerebro-spinal fluid.

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H. W. Siemens and J. H. Broekema (*Nederl. Tijdschr. v. Geneesk.*, January 13th) state that Holland is one of the European countries in which favus is most frequent. In Germany the disease is almost unknown, as is shown by the fact that in Munich only four cases were seen in the course of a year, in Kiel ten cases in eight years, and in Hamburg four cases in six years. In the Leyden district, on the other hand, 250 fresh cases were seen in less than four years. The prevalence of favus in Holland is attributed to the fact that a large proportion of the patients refuse treatment owing to their ignorance of the risks connected with the disease. Moreover, many Dutch physicians are said to be ignorant of the principles of the modern treatment of favus. The authors maintain that the disease can only be eradicated by enlightenment of the public, which could be effected by the formation of a special association. In the meanwhile it is desirable that favus should be added to the list of diseases infection with which debar children from attending school.

A FURTHER INVESTIGATION ON EXCRETORY TUBERCLE BACILLURIA

BY

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Despite the progress of modern research in the elucidation of many aspects of renal function, authorities still differ on the apparently simple question as to whether or not micro-organisms can pass through the healthy kidney. This problem has a clinical as well as a scientific interest. It has from time to time engaged the attention of various workers, so that the lack of unanimity is not due to want of interest.

Wysokowitsch¹ (1836), using various micro-organisms, found renal lesions essential for transmission. Others who have agreed with this view, with the organisms on which they have based their conclusions, are: Boccardi² (1888) (anthrax bacilli); Pernice and Scagliosi³ (1892) (*Staphylococcus aureus*); Sherrington⁴ (1893) (various organisms); Cotton⁵ (1895) (*Staphylococcus aureus*); and Lepper⁶ (1921) (coliform organisms). On the other hand, Sittmann⁷ (1894) concluded that the staphylococcus could pass through a healthy kidney. Great disagreement exists also on this question in regard to the tubercle bacillus. Killeuthemer⁸ (1914) obtained negative biological results in guinea-pigs with the albumin-free urines of thirteen advanced tuberculous patients, whereas three of eleven specimens showing albumin, and taken from similar patients, were positive, although these three patients revealed no post-mortem evidence of genito-urinary tuberculosis. He therefore concluded that tubercle bacilli could not pass through a healthy kidney, but might do so through an impaired organ, although no actual renal tuberculosis was present. Medlar and Sasano⁹ (1924), after examining 30,000 serial sections of the kidneys of twelve tuberculous guinea-pigs and four tuberculous rabbits, formed the opinion that renal tuberculosis was present in every instance in which tubercle bacilli were found in the urine during life, and that there was no evidence to suggest the excretion of these organisms by a normal kidney. Bumpus and Thompson¹⁰ (1930) did not think it was possible for a normal kidney to filter tubercle bacilli from the blood stream into the urine. Rieder¹¹ (1931) found urogenital tuberculosis by operation, or post mortem, in all the eleven instances in which he had recovered tubercle bacilli from the urine. The present writer¹² (1932) found only one urine positive out of seventy-six single specimens from seventy-six patients with advanced pulmonary tuberculosis, and repeated examinations revealed persistent albuminuria in this instance. On the other hand, Foulerton and Hillier¹³ (1901) obtained six positive urines from six tuberculous patients without being able to find any post-mortem evidence of genito-urinary involvement. Churchman¹⁴ (1914), Brown¹⁵ (1915), Geisinger¹⁶ (1917), Caulk¹⁷ (1921), Hobbs¹⁸ (1923), Smith¹⁹ (1924), Ekehorn²⁰ (1923), and many other authorities, including Calmette, have expressed themselves in favour of the possible occurrence of excretory tubercle bacilluria. More recently, Ramel²¹ (1932) formed similar conclusions, believing that he had encountered six instances of transitory tubercle bacilluria; but this authority like some of the others expressing similar opinions, seems to have laid undue stress on normal renal function tests, and it is not clear if he cut serial sections to exclude active genito-urinary tuberculosis.

PRESENT INVESTIGATION

A healthy young adult rabbit excreting normal urine received 66.5 mg. of living human tubercle bacilli intravenously. Twenty-four-hour specimens of urine were tested chemically, microscopically, and biologically from the first to the sixth day inclusive. No abnormality and no evidence of the excretion of tubercle bacilli was found, despite the fact that the guinea-pigs inoculated with the urine were kept alive for several months. The rabbit, killed late on the sixth day, showed no macroscopic

changes, and serial sections of the kidneys failed to reveal tubercle bacilli, although significant collections of round cells were found scattered sparsely throughout these organs.

A second healthy rabbit was given 163 mg. of living human tubercle bacilli intramuscularly, and twenty-four-hour specimens of urine taken from the first to the third day inclusive did not show any chemical, microscopical, or biological abnormality. The animal was killed at the end of the third day. No tubercle bacilli were found in the kidneys; collections of round cells were present, but to a less extent than in the first rabbit.

Ten forty-eight-hour specimens of apparently normal urine from ten guinea-pigs with advanced tuberculosis were tested on ten healthy cavies with three positive results. None of the original animals showed frank tuberculosis of the kidneys microscopically, the brunt of the disease falling on spleen, liver, and lymphatic system. These kidneys, however, could not be considered normal, as they showed degeneration of the tubular epithelium, cellular foci in the interstitial tissue, and other changes which could be attributed directly or indirectly to the toxæmia and other constitutional effects resulting from the presence of tubercle bacilli in large numbers in the other organs. It is noteworthy that the three tuberculous cavies showing tubercle bacilli in the urine exhibited these renal changes more extensively than the remaining seven animals.

As previously seventy-six single samples of urine had been tested from individual patients, it was now thought advisable to do repeated tests on a smaller number of infected people to exclude the possibility of periodicity in excretion. Any patient showing albuminuria or other gross change indicative of renal abnormality was discarded. One hundred specimens of urine were tested biologically, this number being taken from twenty-two patients, ten suffering from advanced pulmonary tuberculosis with positive sputa, and twelve showing surgical tuberculosis in an active state—mainly of the bone and joint variety. Of the hundred samples, eighteen were twenty-four-hour specimens—twelve from the surgical and six from the pulmonary patients. One sample only, the fourth single specimen from a man suffering from advanced phthisis, gave a positive biological reaction, and ten further samples, including one twenty-four-hour specimen, failed to repeat this result, but all the later specimens of urine showed hyaline and granular casts, which had not revealed themselves in the first four specimens: if they had, this patient would not have been included in the investigation. At the time of writing the casts persist, but there is no albuminuria, and the renal function tests are normal.

DISCUSSION

The fact that the rabbit's urine did not show tubercle bacilli after the intravenous administration of such a large dose seemed to afford strong evidence against excretory bacilluria. One must remember, however, that the rabbit has a comparatively high resistance to human tubercle bacilli, and the possibility of rapid destruction of the majority of the micro-organisms by autolysis or other means at once arose; for the collection of round cells in the kidneys appeared to indicate that tubercle bacilli had reached these organs, and the failure to find them suggested that they had been destroyed. Comparatively few tubercle bacilli were found in the spleen and liver, and a large proportion of these organisms were held up in the lungs. Additional experiments confirmed this finding, which was first suggested by Mr. Sworn of Stafford as a possible explanation of the paucity of tubercle bacilli in the abdominal organs and in the arterial blood after intravenous inoculation. Further work is being done on this aspect. The fact remains, however, that although some of the organisms gained access to the general circula-

tion, probably even in greater numbers than in natural human infection, none were excreted in the urine.

The three cavies showing positive urines presented a different set of circumstances. Their urines were tested when they were in an advanced stage of disease caused by an organism to which they are highly susceptible—that is, the bovine tubercle bacillus. Their kidneys, although not obviously tuberculous, were subject to the strains of toxæmia and altered metabolism. Consequently, these results cannot be claimed as evidence of excretory bacilluria by the normal kidney, but can be put forward in support of the idea that tubercle bacilli may escape from a distant focus through this organ when it is impaired from causes other than renal tuberculosis.

The human positive urine can be similarly explained. The casts were few, but they were sufficiently persistent to point to abnormality.

CONCLUSIONS

The results of this investigation do not confirm the opinion that tubercle bacilli can pass through a normal kidney, but they support the contention that these micro-organisms may gain access to the urine in the absence of renal tuberculosis when the normal action of the kidney is impaired, either indirectly as the result of extensive tuberculosis elsewhere or in consequence of independent renal disease.

My thanks are due to Dr. J. Stevenson and Miss M. Mulvein for their kindness in securing the necessary specimens and for supplying the clinical details of the patients, and I acknowledge my indebtedness to Mr. B. R. Sworn of Stafford and Dr. T. V. Cooper for supplying me with some of the original references.

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With the title of "What the City is Doing for the Public Health," Dr. G. H. Masson, medical officer of health for Port-of-Spain, Trinidad, has published a health week address, delivered at the Royal Victoria Institute, Port-of-Spain, on October 2nd, 1933. It reviews the various activities of the municipal council, including scavenging, removal of house refuse, water supply, sewerage and sewage disposal, slaughtering, markets, and food protection. The lack of attention paid to tuberculosis comes in for acid comment, most of the education work in respect of its prevention being undertaken by the Association for the Prevention and Treatment of Tuberculosis, with the tuberculosis dispensary as its centre of activity. There are tuberculosis wards at the Colonial Hospital, which play a useful part by housing open cases, but there is no sanatorium for the early and curable cases. The prevalence of this disease is attributed to the extent of bad housing and overcrowding. A tabulated comparative summary of vital statistics for the years 1922 and 1932 reveals the progress in the diminution of disease which has been achieved, and this simple and humorously written statement of the work of the public health department should enable future advances to be made, thanks to the creation of a more interested and more instructed public outlook.